Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

OCTOBER, 1961

CONTENTS:

Control in Aluminum Anodizing
Processes and Coatings

Metal Rustproofing Patent Decisions
Phosphating Compounds

Finishing Procedures for Magnesium and Magnesium Base Alloys
Plating on Magnesium

New Methods of Determination of Adhesion and Fatigue Strength of Electrodeposited Antifrictional Coatings
Russian Research Developments

Synthetic Resins
Alkyds

Finishing Pointers
Volumetric Determination of Zinc and Copper in Brass Plating Solutions

Science for Electroplaters
Brighteners

Complete Contents Page 51

Read and pass on—

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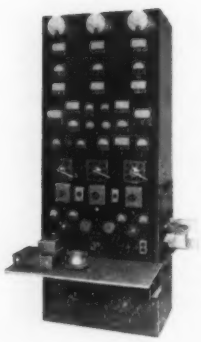
PLATING POWER BY DC POWER SPECIALISTS

Mathematical Design from Scripta Mathematica

DESIGN

is a big word at RAPID ELECTRIC



From the design board to the test board specialists are at work at RAPID.

Because RAPID specializes in dc power supplies and controls, each member of its staff is a specialist in his own right. Whether it is a design engineer or a trained technician each becomes integrated and woven into a highly skilled group whose main thought is dc power supplies.

That's why RAPID offers *so much more* in the way of dc power rectification. That's why RAPID units are distinctively different. (Your local distributor sells RAPID—call on him today. Name available upon request.)

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ALUMON "D"®

Plating on aluminum made easy

WITH ALUMON "D" DILUTE ZINCATE

BLISTER-FREE PLATING ON COMPLEX PARTS

Alumon "D" quickly penetrates blind holes, screw threads, grooves, other areas difficult to plate using ordinary zincate baths. Adhesion is excellent; solution rinses freely; and carry-over into plating baths is minimized. Parts shown are plated aluminum components of the U.S. Army Hawk missile weapons system produced by Raytheon's Aero-Weapons Division.

REDUCES DRAGOUT

Alumon "D" thin liquid drains rapidly, reducing solution dragout losses to a minimum. In laboratory tests on identical parts, the amount of solution dragged out of an Alumon "D" bath was less than 1/3 the amount dragged out of a conventional zincate bath. The amount of salts dragged out is less than 1/12 as much.

SHORTENS MAKE-UP TIME

Alumon "D" is easy to make up. One hundred gallons of solution requires addition of only 20 gallons of Alumon "D" Liquid (or 100 lbs. of Alumon "D" Powder) to water, compared with dissolution of 450-500 lbs. of powdered chemicals for a conventional bath. For detailed information, write today to: Enthone Incorporated, 442 Elm Street, New Haven 8, Conn.

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A Subsidiary of American Smelting and Refining Company ASARCO

For the brightest electroplating

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

Three stages in finishing a zinc base die casting. Buffed part (center) is followed by electrocleaning in Oakite 195 (right). Hand holds plated part. Notice how electrocleaned part at right retains all the luster and color of the buffed part.

New Oakite electrocleaner assures brighter plate, fewer rejects for zinc die castings

It's non-etching and non-discoloring — that's why new electrocleaner Oakite 195 assures a brighter chromium luster, fewer plating rejects. Used with direct, reverse or periodic reverse current, it removes soils without dulling or darkening the buffed surface. It makes plating of zinc die castings a more dependable, more economical operation. Proof? Many users report *no* rejects due to poor electrocleaning *for the first time* in their experience.

Oakite 195 rinses easily, too, and has low foaming tendencies. Works well with copper and brass alloys, steel, lead and brittania metal, as well as zinc, making it ideal for service where several metals are cleaned in the same bath.

It's an excellent, profit-boosting material, but it's only *one* of a whole Oakite line. Ask the Oakite man to help you select the electrocleaner that gives you the brightest parts along with the brightest profit-picture. Or, write for Bulletin F-10466. Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

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over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

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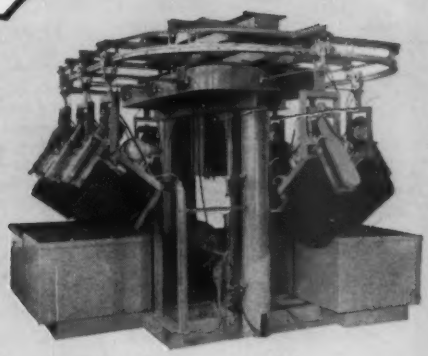
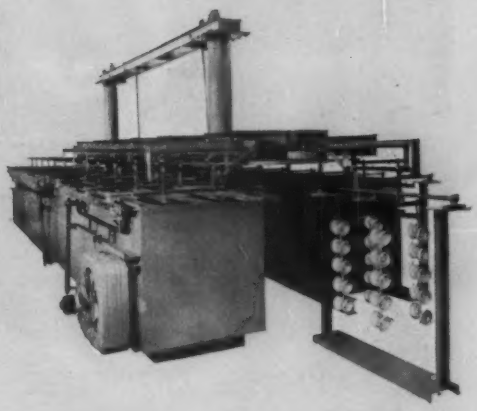
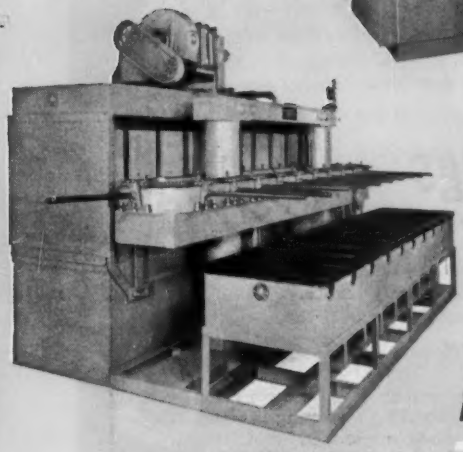
CROWN AUTOMATICS



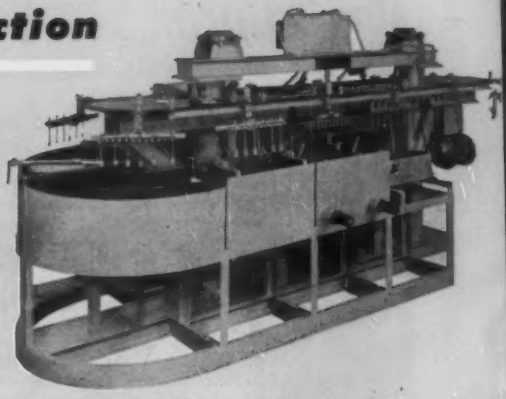


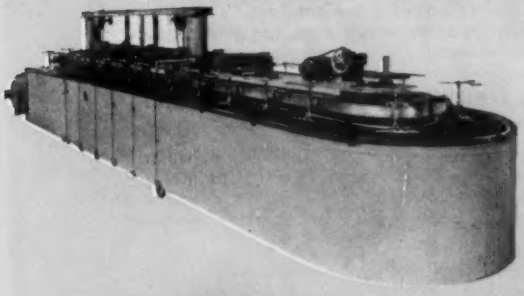


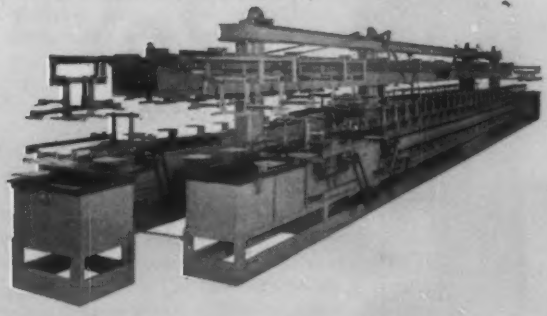
increase production

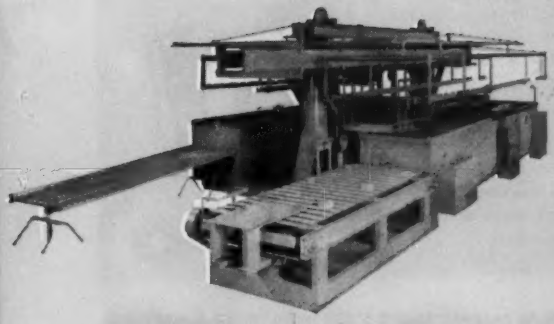
reduce costs

improve quality









Crown Automatics are ideal for plating your barrel or racked work. Crown manufactures the widest variety of fully automatic plating machines in the industry... *there is a model to fit your needs.* Write us details of your job and production requirements.

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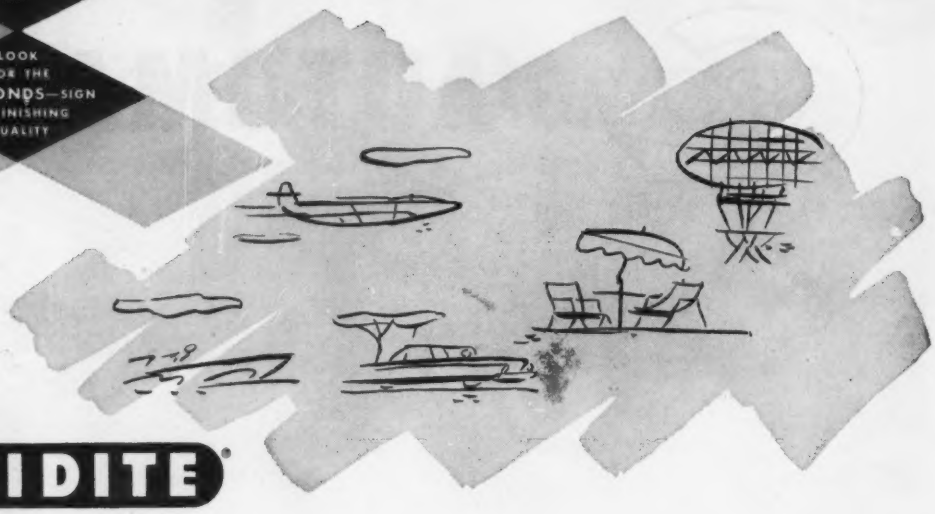

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Chromate Conversion Coatings

Give you 5 additional benefits for Corrosion Protection—Paint Base—Decorative Finishing

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Developed for specific applications, there is an Iridite to provide the finish you desire, fit the equipment you have available and give the performance you require. Most Iridite coatings meet rigid military and civilian specifications.

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4 ECONOMY

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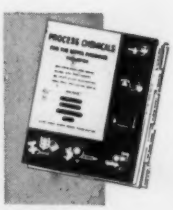
If you have an unusual application, we will gladly work with you. Our entire staff of experienced engineers and chemists, and our completely equipped facilities are at your service.

IRIDITE—a specialized line of chromate conversion coatings for non-ferrous metals. Apply by dip, brush or spray methods — at room temperature — manually or with automatic equipment. Forms a thin film which becomes an integral part of the metal. Cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel required.



If you are using chromate conversion coatings to finish zinc, cadmium, aluminum, magnesium, silver, copper, brass or bronze — consider the above benefits of Iridite. For complete information, contact your Allied Field Engineer. He's listed under "Plating Supplies" in the yellow pages. Or, write for FREE TECHNICAL DATA FILE.

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FULLY AUTOMATIC
PLATER & ANODIZER

ONE MAN

handles complete operation of this

MOST VERSATILE

OF ALL AUTOMATICS

Conveyor Breakdowns Eliminated with new electro-mechanical control and safety device. Racks can't be pushed into sides of tank; load can't drop if power fails during work transfers.

Positive 6-Point Connections. Self-cleaning heavy duty contacts need little or no attention.

Rack Carriers Quickly Removed. A big time saver when servicing, or manually plating large pieces.

Fast Cycle Changes by shifting tank partitions and moving pick-up heads.

No Extra Headroom Required. All elevating mechanism operates below top of rack carrier.

Automatic Loading And Unloading of racks.

Delayed Set-Down to operate automatically with cycle. Furnished if required for conversion coatings and bright dips.

If More Than One Cycle is necessary, by-passing can be built in.

Hydraulic operation, standard.
Pneumatic operation, optional.

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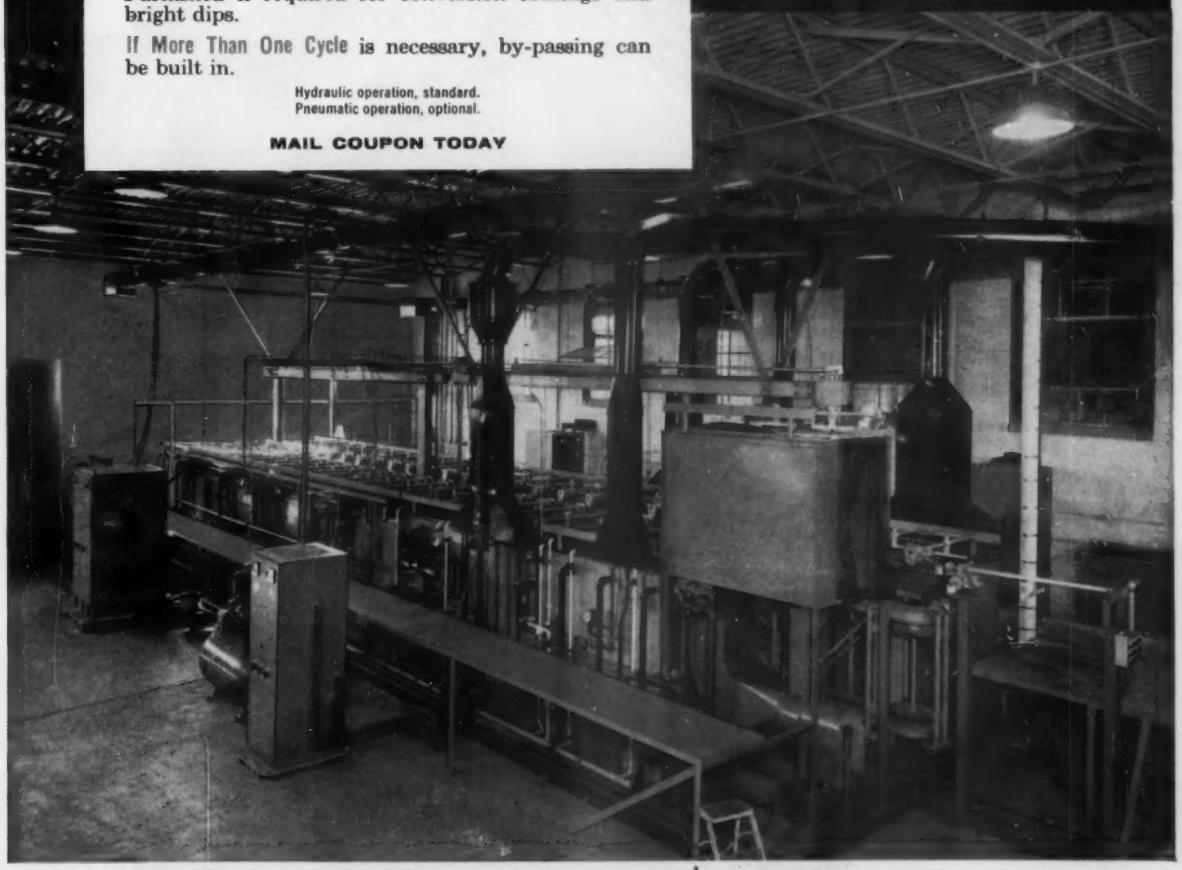

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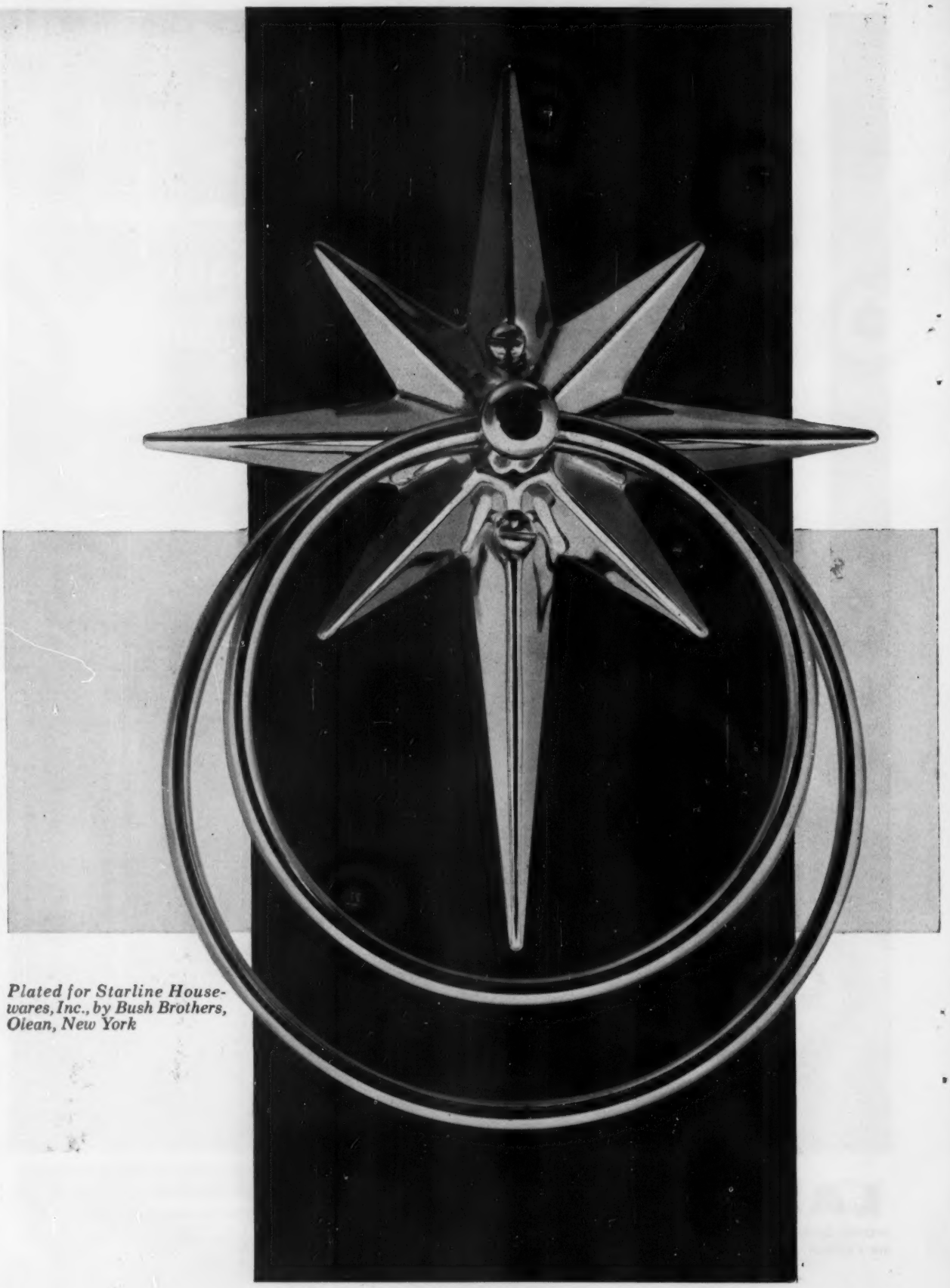
ATTACH TO COMPANY LETTERHEAD

Send complete information on fully automatic Cycleflex

Name.....

Title.....



Plated for Starline Housewares, Inc., by Bush Brothers, Olean, New York

NO DEGREASING
NO DEBURRING
NO COPPER PLATING
NO COPPER BUFFING
on this nickel-chrome plated fixture

...just chrome over
SUPERLUME
on a raw steel stamping

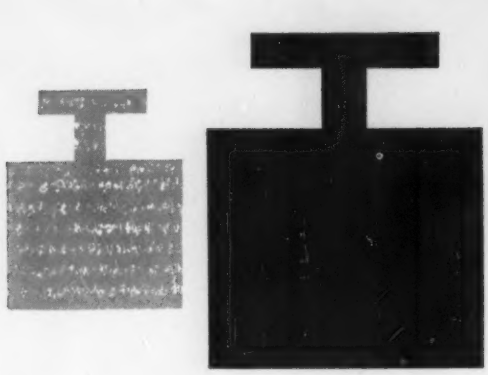
It used to take *six* operations to get the high-luster finish demanded by Starline Housewares for this chrome-plated towel ring. Now it takes only *two*.

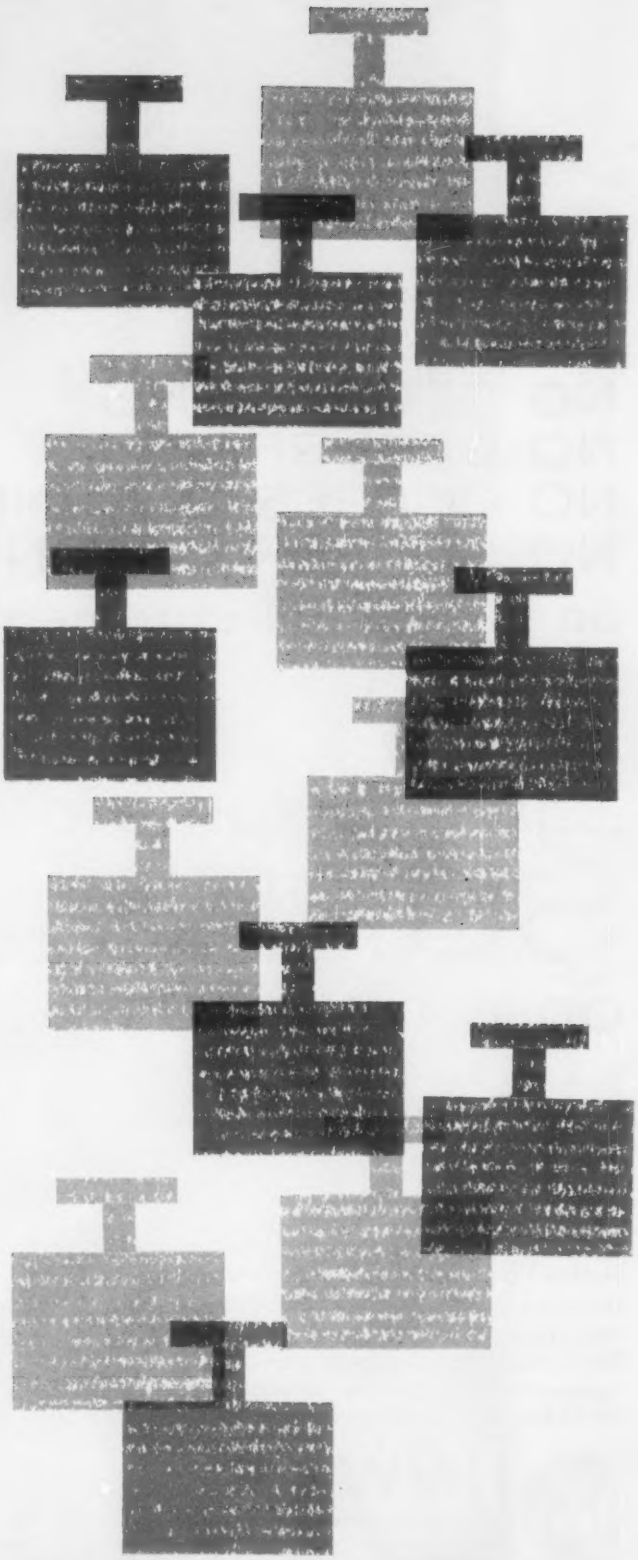
Difference in finish quality? *Absolutely none*, agreed the plating experts who scrutinized random samples from batches produced both ways.

Maybe Superlume belongs in *your* plant, too. This high-leveling, super-bright nickel bath is economical with most die castings and virtually all high-grade steel products. For technical details on these and other money-saving uses, ask H-VW-M.

H-VW-M *Progress in metalfinishing through advanced processes • equipment*

Hanson-Van Winkle-Munning Company, Matawan, New Jersey • Offices in Principal Cities
Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco





Research... the 'seventeenth ounce' in the CLEPO POUND

The 'seventeenth ounce' in every pound of Gumm products is an unseen, unmeasurable, but positive and ever-present value. It is a product *in itself* of twenty-seven-plus years of inquiry, testing, and development in one specific range of products—the compounds and processes required by the Metal Finishing Industry.

It is not surprising that this *concentration* of effort has earned an enviable reputation for meeting the many and varied requirements of the Industry. The daily work of the CLEPO Laboratories at Kearny—where new, often highly-specialized problems are analyzed, and solved—is a continuation of the 'seventeenth ounce' principle.

Research, *with* Service, is another chapter from our own book: How to Serve the Metal Finishing Industry—*Better*. If you want the advantages only the specialist in the field *is able* to offer, write or call

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CLEPO

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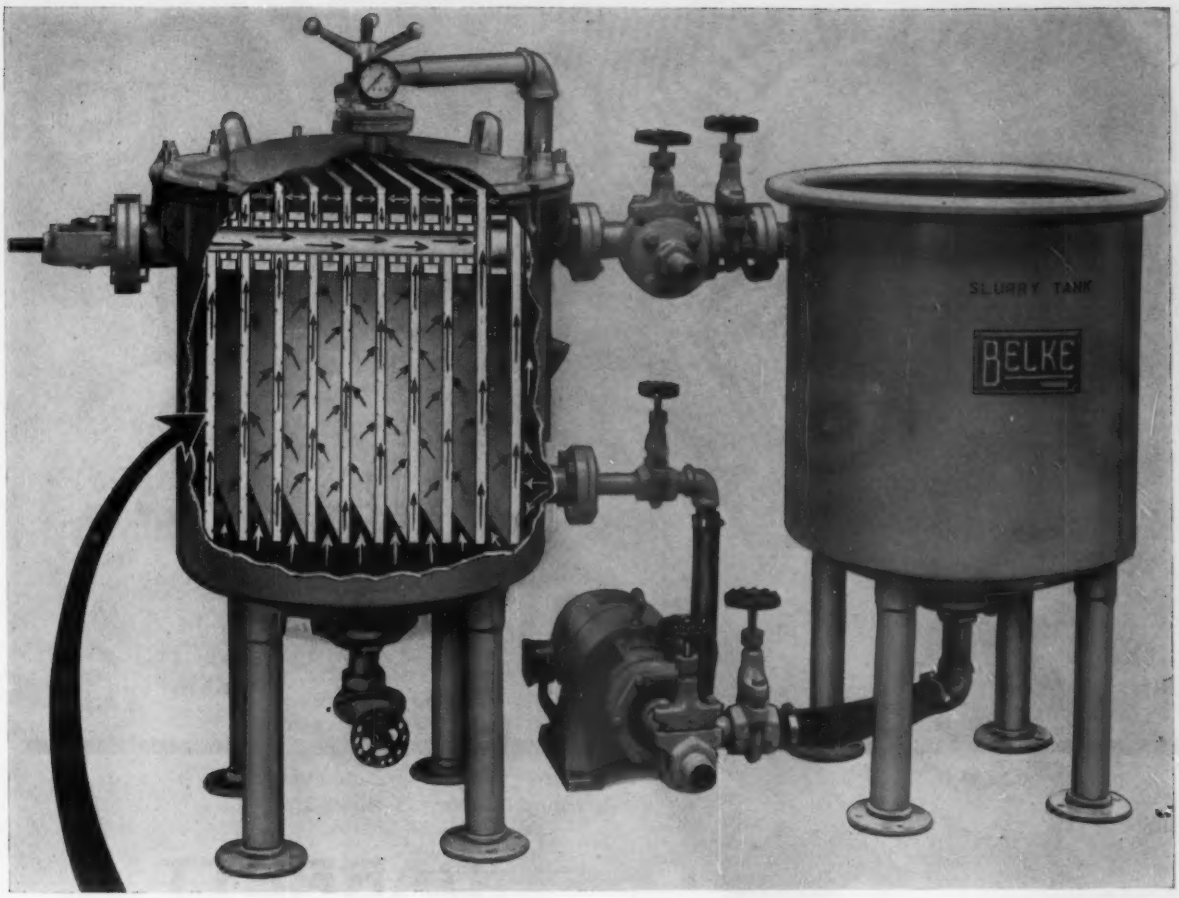

Filter Area determines *REAL* Filtering Capacity

The BELKE Filter Bulletin shows how BELKE Filters maintain high filtering efficiency. Send for your copy today.

Round, square or flat — no matter what shape — **unless you have the necessary square feet of filtering area you do not get the filtering capacity.**

That's why, since 1921, BELKE Filters have provided the great filtering area needed to assure high plating efficiency and long operating periods between cleanouts.

No matter how large your filtering requirements — 2000, 4000, 6000, or 10,000 gallons per hour — we can meet them with BELKE durable, long wearing filters of premium efficiency, designed and priced to give you the most filtering obtainable

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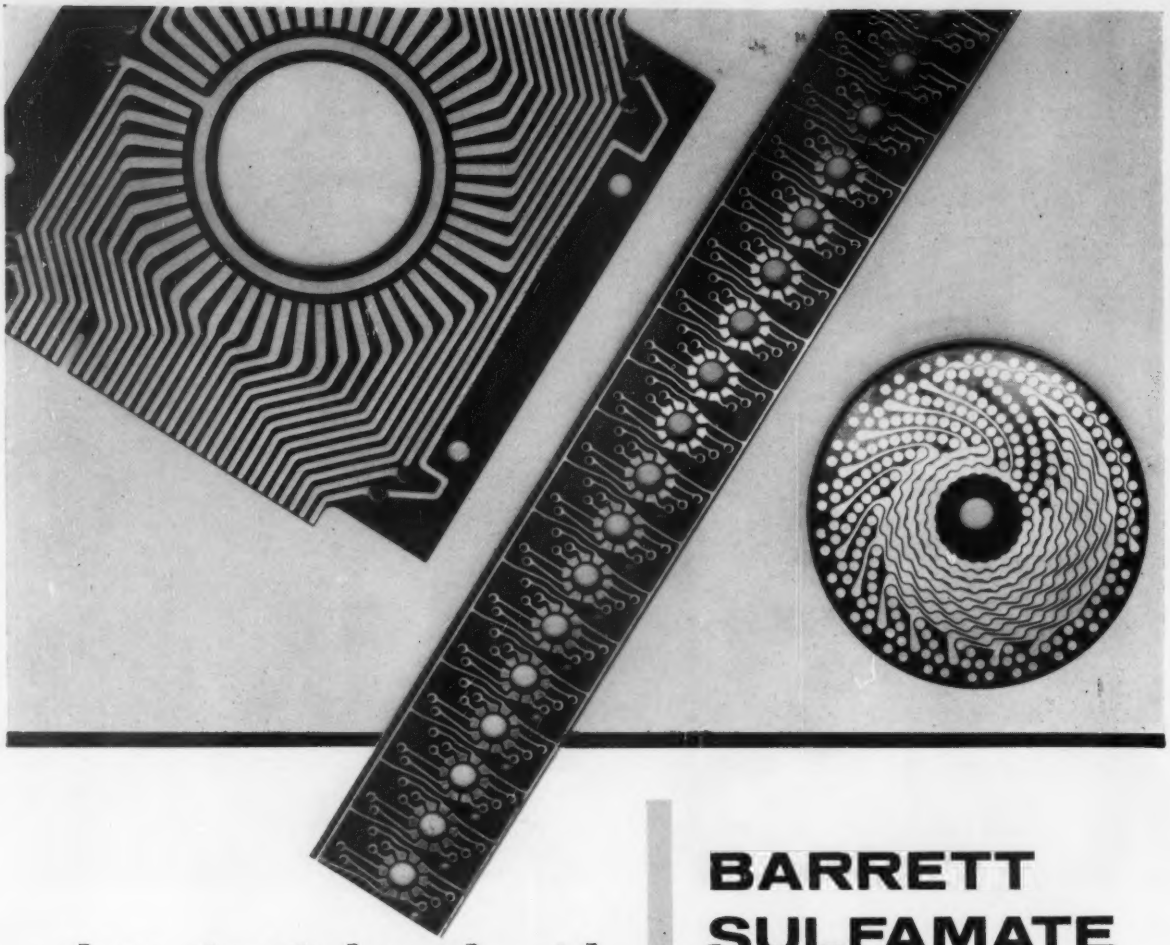

plate circuit boards with

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- Exceptionally low tensile stress without the use of organic addition agents
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FEDERATED PLATING SUPPLIES

CONSISTENT HIGH QUALITY PLATING WITH TESTED, PROVED MATERIALS

Use these tested, proved-in-use chemicals and anodes for fast, economical, always consistent quality plating:

High efficiency anodes in brass, cadmium, copper, lead, nickel, tin, tin-lead and zinc.

Asarco-Max copper anodes and triple-life Conducta-Core lead anodes.

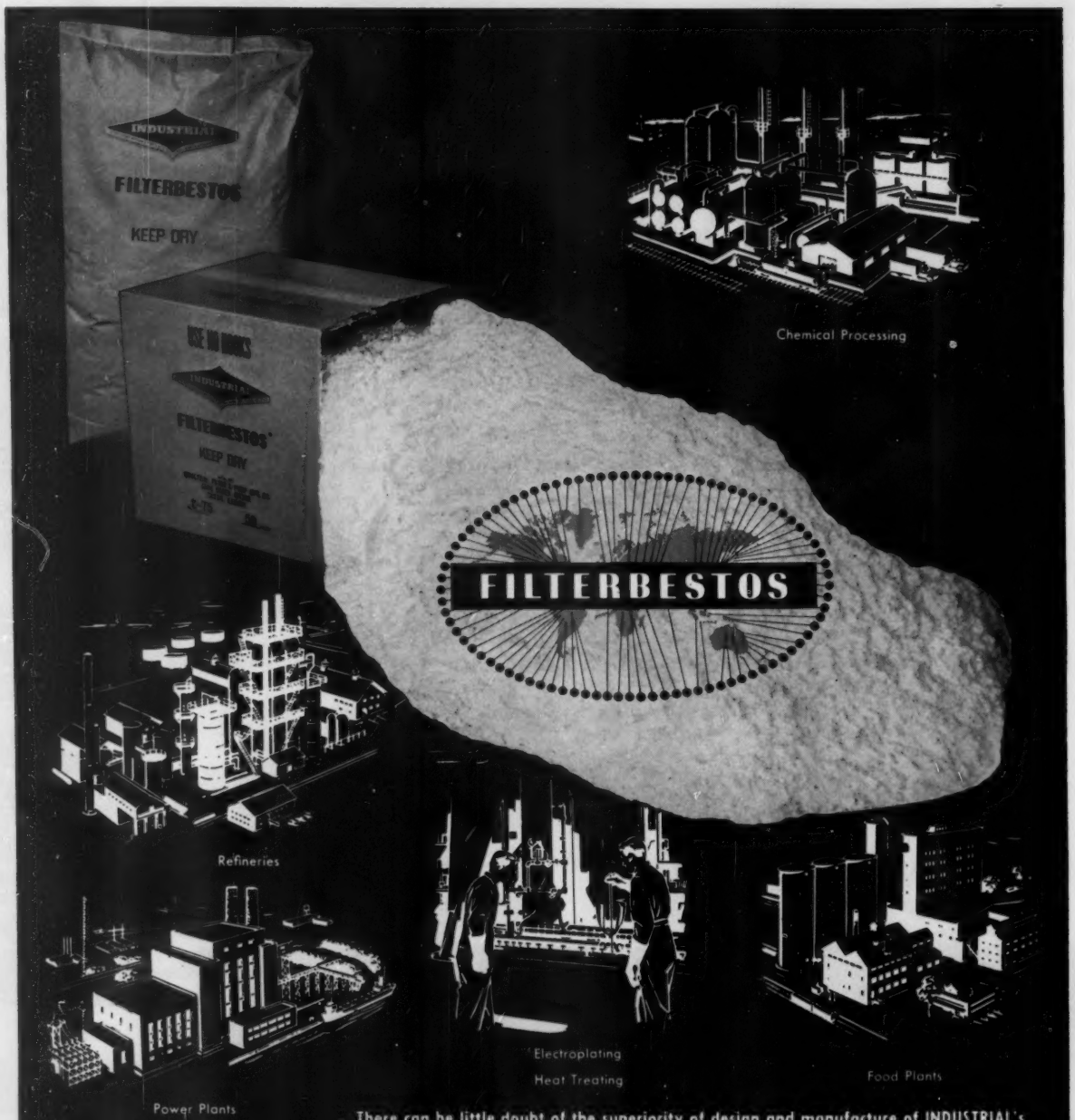
Asarco nickel salts of high purity and uniformity.

Brighteners: Cadmax (cadmium), Zimax (zinc), Levelmax & Nimax (nickel).

All have set new industry performance standards.

For full information on plating materials and expert help on individual problems, call or write: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y., RE 2-9500, or call our nearest sales office or Federated plating materials distributor.
In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

ASARCO



There can be little doubt of the superiority of design and manufacture of INDUSTRIAL's Filtration equipment — but did you realize that INDUSTRIAL also manufactures a superior family of filter aids under the trade name of FILTERBESTOS?*

Over a third of a century of carefully catalogued experience is crammed in every package. INDUSTRIAL produces over a dozen grades of only the highest quality filter aids, each tailored for a specific family of uses. Yet, because of high manufacturing efficiency and product quality — FILTERBESTOS is actually LESS expensive to use.

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PRESSURE FILTERS ♦ ION EXCHANGERS ♦ CORROSION TEST CABINETS ♦ PUMPS ♦ WATER & WASTE-TREATING EQUIPMENT

All HARSHAW Nickel and Copper Plating Processes Operate Successfully with Either

CATHODE MOVEMENT OR AIR AGITATION!

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All Harshaw processes have been highly successful in their operation with mechanical agitation. Where particular conditions have dictated the need for Air Agitation, Harshaw processes are operated very effectively with beneficial results. If your requirements indicate that Air Agitation will benefit you, Harshaw is prepared to offer a suitable process.

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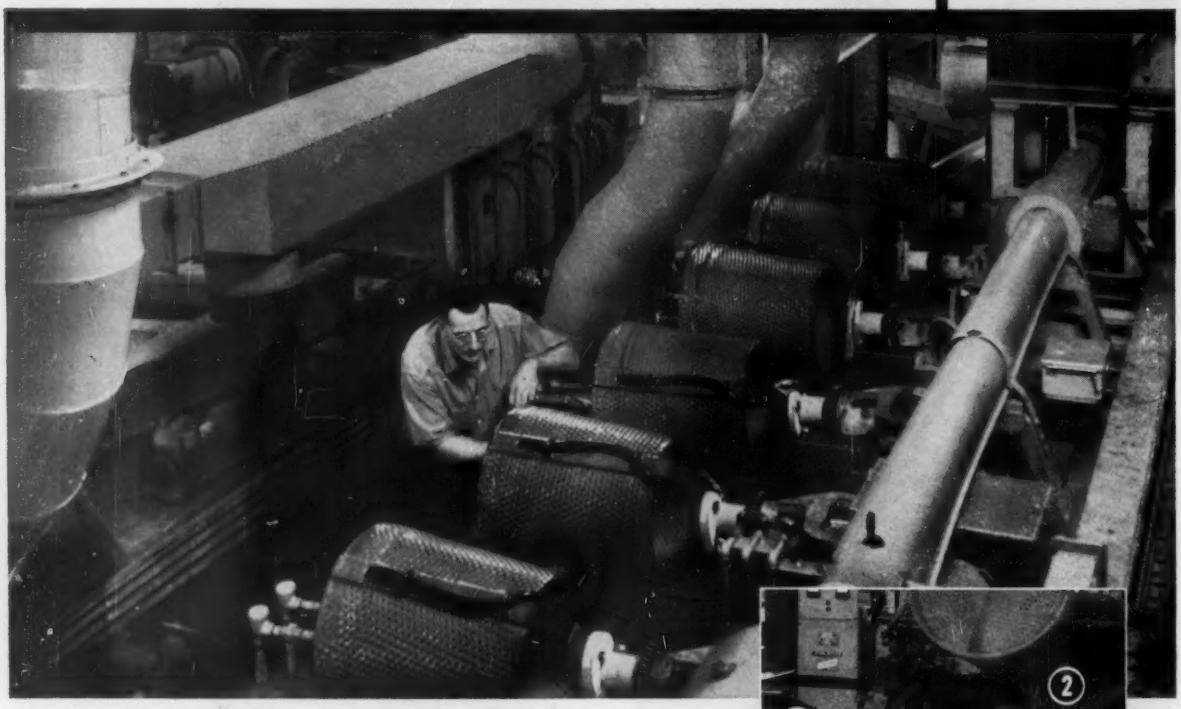
STEVENS helps triple plating production per man at INTERNATIONAL HARVESTER

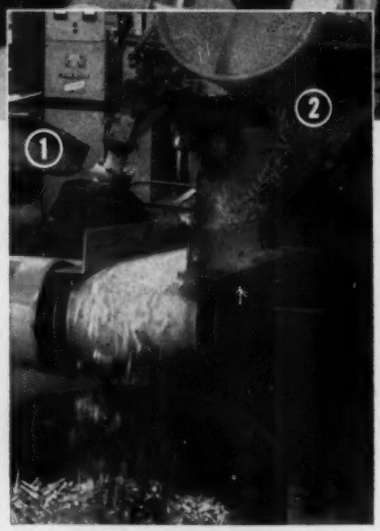


Stevens Automatic Barrel Machine eliminates plating backlog, increases production, lowers costs.

Installation of a Stevens Model C Automatic Barrel Machine has tripled production-per-man on the zinc plating operation at the West Pullman Works of the International Harvester Company.

The completely automatic operation of the Stevens Model C has reduced the number of operators from two to one on each shift, while the overall production rate has risen 50%. Automatic loading, unloading and built-in drying, plus extreme simplicity of control, keep labor requirements at a minimum. Normal production flow is maintained on several thousand types of fasteners, bolts and nuts for this world-famous manufacturer of farm equipment.

In addition to these important production bonuses, you'll also save on the minimum space and maintenance requirements of the Stevens Model C. It's the ideal cost-cutter on all production plating and processing of small and medium-size parts. Call your Stevens Representative today for complete information, or write direct to:



(1) Loading chute automatically directs weighed parts into Stevens oblique, lidless barrels.

(2) Plated parts are automatically dumped directly onto a conveyor belt which transfers them to storage containers. No manual handling of parts is required.

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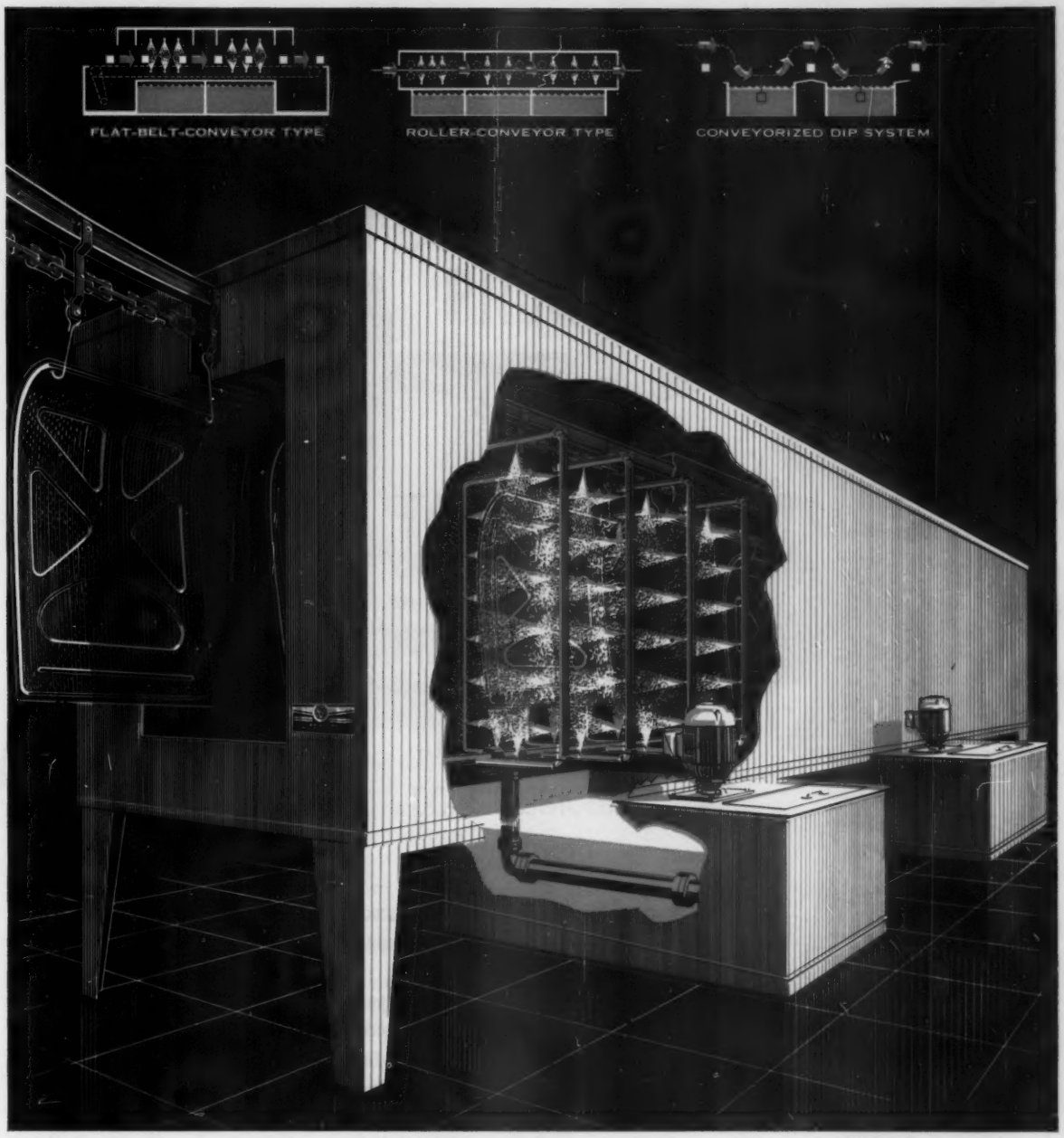

power spray washers from DeVilbiss for metal cleaning and surface preparation are offered in both standard and custom designs to meet your exact operating problem. We work closely with your engineers to match machines to cleaning processes, surface treatments, and production requirements — to assure highest efficiency. Engineering, installation, and service facilities are available from coast to coast.

Talk to DeVilbiss about all your metal cleaning and treating needs

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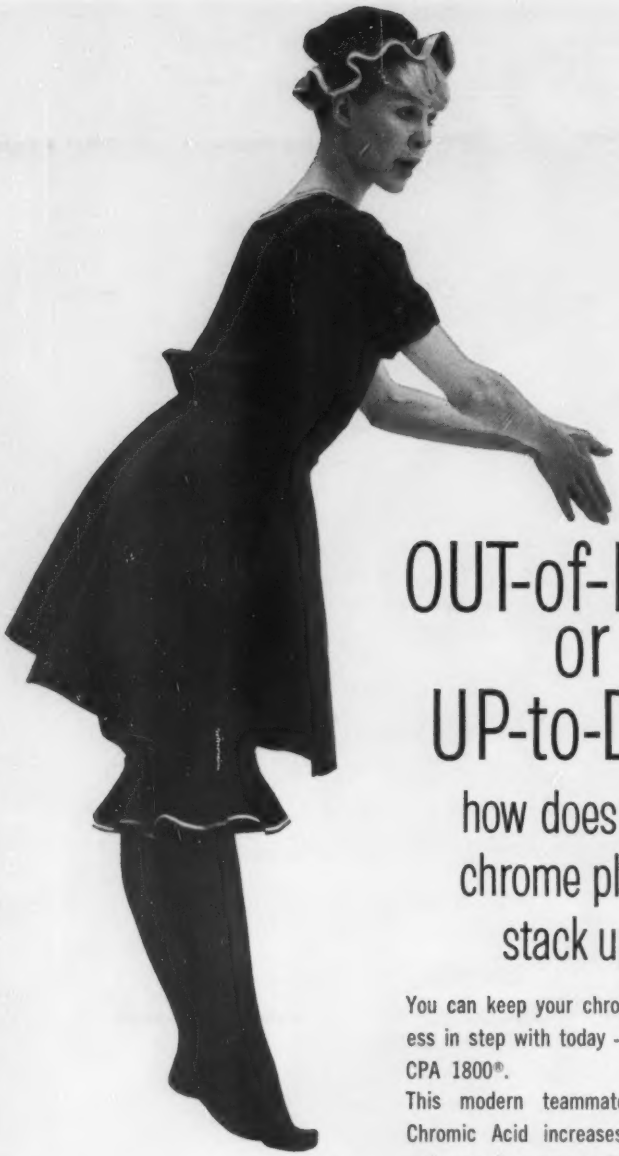


OUT-of-DATE or UP-to-DATE

how does your chrome plating stack up?

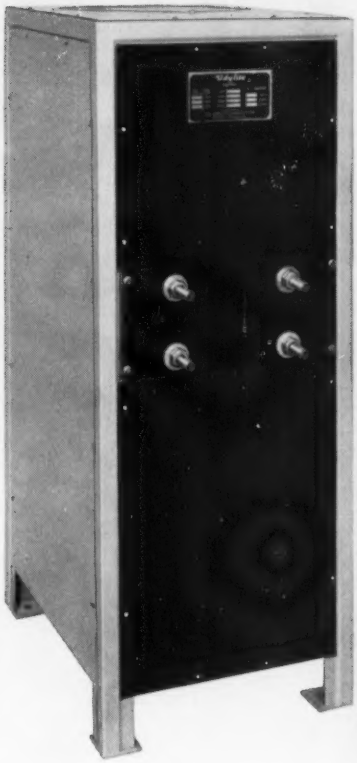
You can keep your chrome-plating process in step with today — with Diamond CPA 1800®.

This modern teammate for Diamond Chromic Acid increases plating speed and covering power. Allows a broader operating range. Simplifies anoding and produces a brighter, harder coating. Improves the metallurgical characteristics of chromium plate.

In short: Diamond CPA 1800 cuts your unit costs and saves you money. Diamond developed it. Your Diamond CPA 1800 Distributor can supply it where and when you need it.

For further information — call or write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals



take advantage of the

NEW PROJECT ALERT RECTIFIER PROGRAM

Rebuild your old equipment now!

Now's the right time to let Udylite electrical equipment specialists rebuild your old, inefficient, 6-, 9- and 12-volt UM and UV rectifiers. You can obtain all of the advantages of a completely new silicon unit at a cost just slightly more than a silicon diode replacement kit. With the exception of the transformer, you'll have *a brand new rectifier from top to bottom.*

NEW, MODERN CABINET features slotted side panels for easy removal and replacement.

UNIFRAME CONSTRUCTION gives increased ruggedness, reduces overall weight.

NEW DIODE ASSEMBLY has newly-designed, one-piece, solid copper, finned heat sink and improved, non-aging silicon diodes with ceramic insulation and individual fuse protection.

NEW VENTILATION SYSTEM with new fan-housing assembly and permanent, built-in baffling assures highest ventilation efficiency.

NEW, LOW HEIGHT saves space. D.C. terminals are located in same relative position, thus new bussing is not required for re-installation.

All transformers are full-load tested before and after re-manufacturing. It will pay you to investigate the many benefits of the Udylite Project Alert factory conversion program today. For conversion of other old-style Udylite Rectifiers to economical silicon units, contact your local Udylite Representative.

SILICON CONVERSION KITS—Udylite Silicon Diode Kits are also available for UV and UM rectifier conversion right in your plant. A specially fabricated heat sink assembly, complete with diodes and fuses, permits fast, easy installation.

Udylite

The Udylite Corporation
Detroit 11, Michigan

udylite

No downtime problems

Udylite Full Automatic Rack Plating Machine photographed on April 4, 1961, at the Chromcraft Corporation. First placed in operation on October 1, 1950. 64' 4" long, 12' 4" wide; with a ceiling height of 15' 1". Racks are 30" x 30" x 60" and tanks are 6' 6" deep, 56" wide.

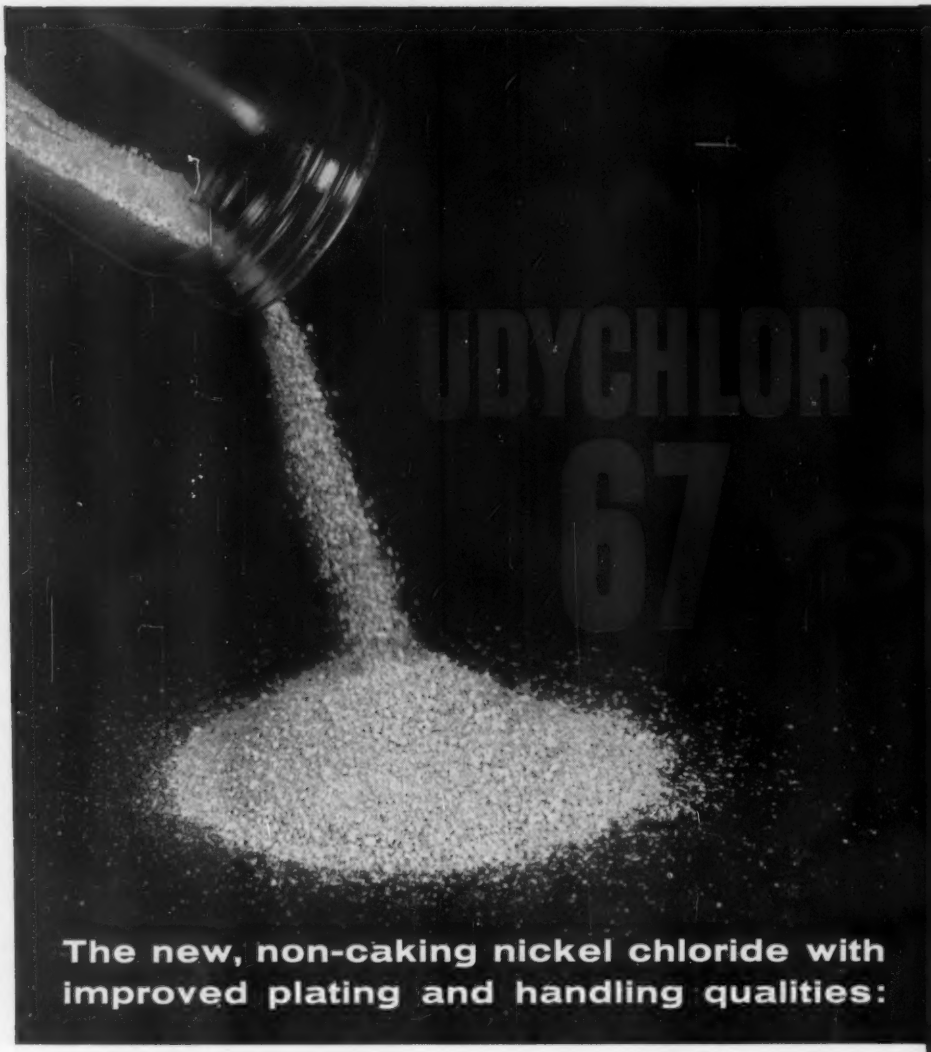
in ten years!

Udylite Full Automatic plates 13 miles of tubing per day for metal furniture leader!

"Our Udylite Full Automatic Rack Plating Machine has more than met extremely heavy production schedules over the last 10-year period—without any significant downtime other than process change-over," states Mr. Irwin C. Keefer, Vice President of the Chromcraft Corporation, St. Louis, Missouri. ■ A leader in the metal furniture industry, Chromcraft Corporation produces more than 500 tables and 3,000 chairs per day. Tubular metal legs and frames are first bright nickel plated in a Udylite Incomparable "66" Process bath. Later they are chrome plated or finished with a gold aniline epoxy coating. ■ "We selected this return-type automatic on the basis of successful past performance of our other Udylite equipment. The need for increased production with uniform high plating quality, ease of operation and reduced maintenance requirements were additional considerations of importance," continues Mr. Keefer. ■ To find out how a Udylite Full Automatic, engineered to meet your specific plating requirements, can improve your production and profit picture, contact your local Udylite Representative, or write:

Udylite

THE UDYLITE CORPORATION
DETROIT 11, MICHIGAN



udylite

The new, non-caking nickel chloride with improved plating and handling qualities:

Gives platers 13% more nickel chloride per pound

New Udychlor 67 nickel chloride with less water content offers platers many advantages not found in ordinary nickel chloride:

- **Purity is higher.**
- **Nickel chloride content has been boosted from 54% to 67%.**
- **Udychlor 67 is non-caking; particles are more uniform.**
- **There's less handling and storage.**
- **It features quick-dissolving characteristics.**

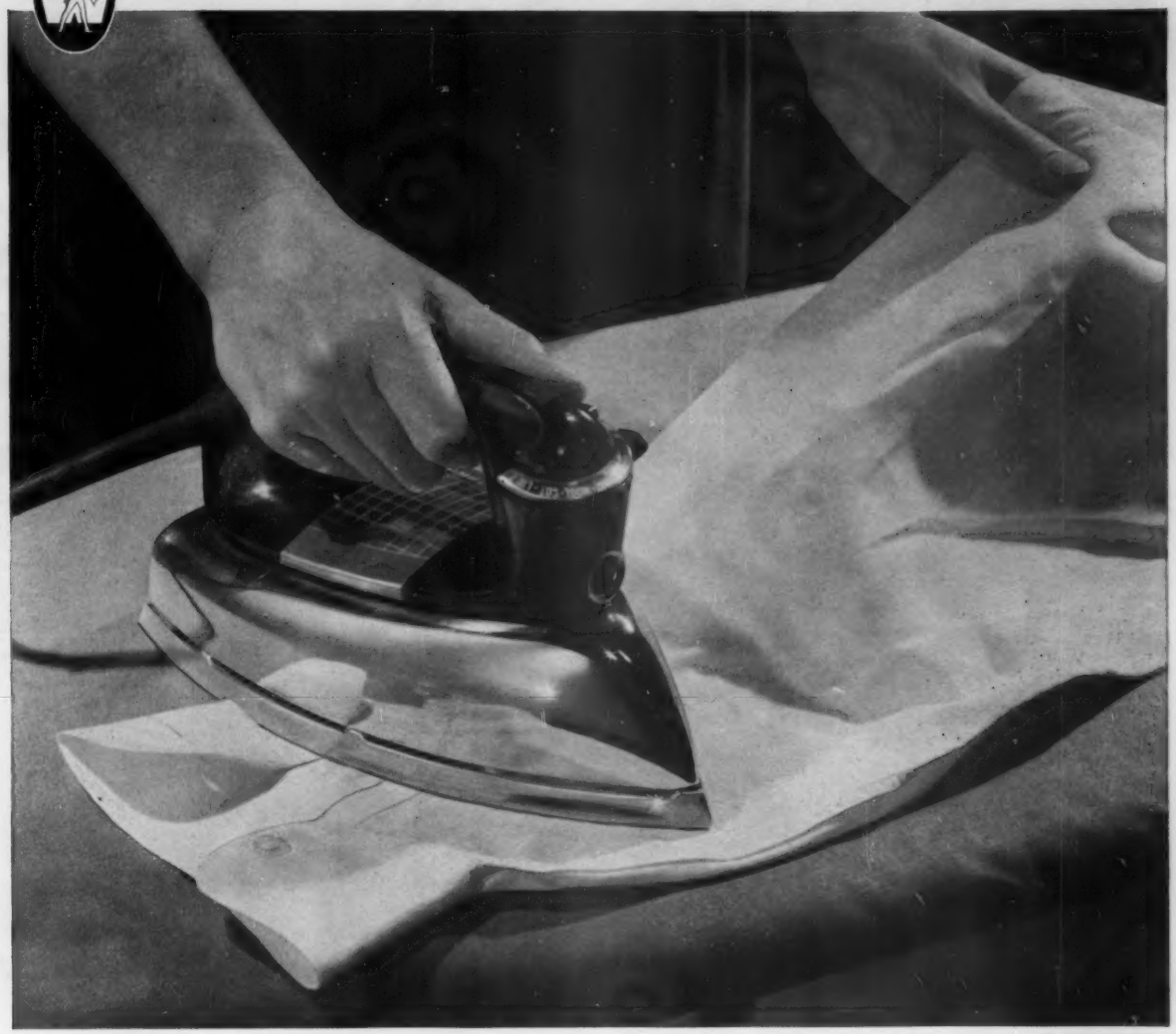
What's more, on the basis of nickel chloride content, you pay no more when you specify Udychlor 67! Its many superior plating and handling features are yours at no extra cost. Order Udychlor 67 today!

world's largest plating supplier

Udylite

The Udylite Corporation
Detroit 11, Michigan

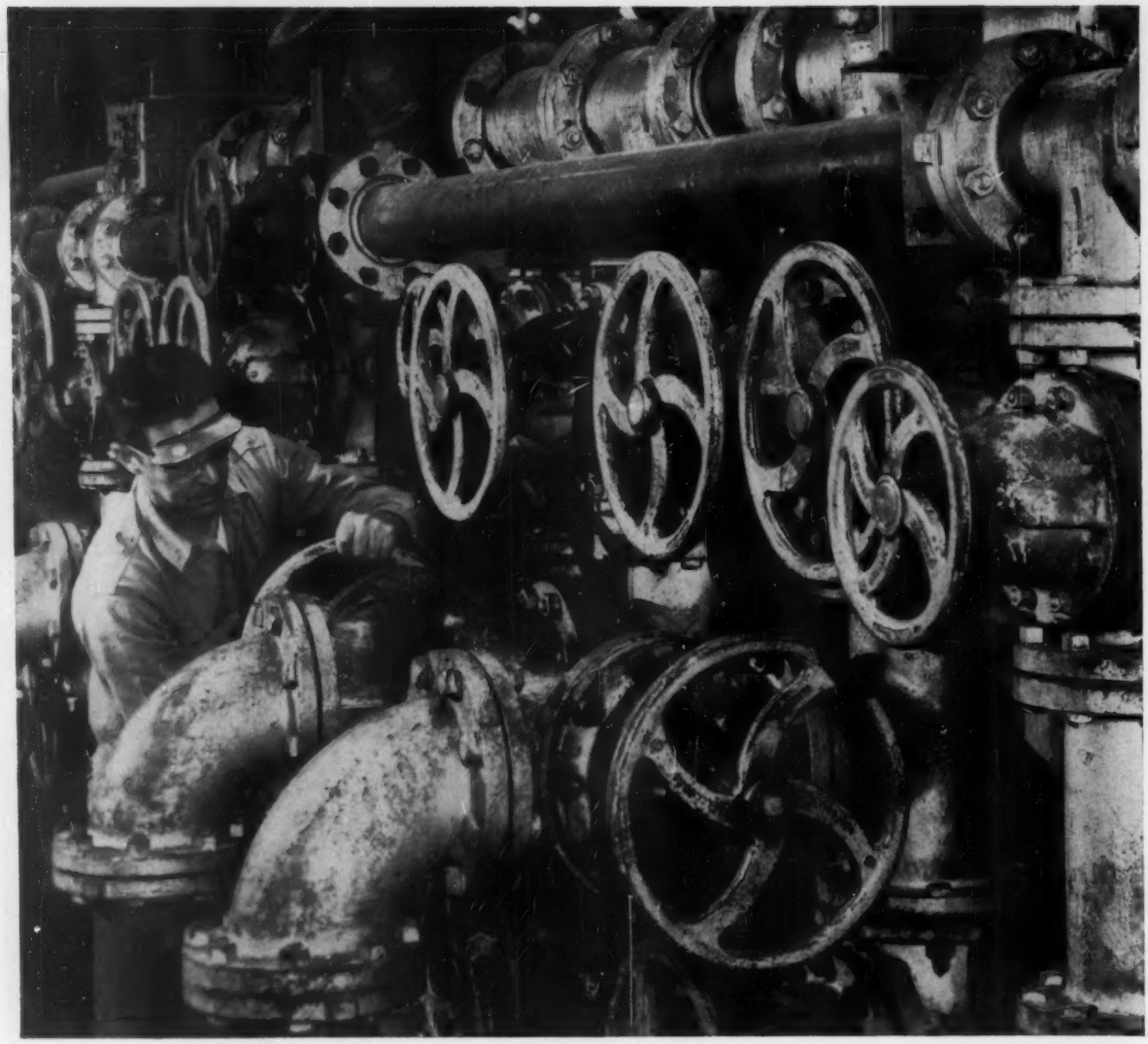
CREATIVE RESEARCH • QUALITY PRODUCTS • PROFESSIONAL SERVICE



What helped put the sparkle in Mrs. Murphy's iron?

Wyandotte BUFSOL® did! BUFSOL is used prior to plating to assure bright adherent electrodeposits. It quickly and completely removes impacted buffing compound, tripoli, rouge in a single soak-tank operation—without solvents. Adaptable to every plating cycle, BUFSOL provides long-lasting solutions and rinses freely so there's no contamination of plating baths. See how your products will take a shine to BUFSOL. Contact your Wyandotte representative today.

Wyandotte Chemicals
J. B. FORD DIVISION
WYANDOTTE, MICHIGAN • LOS NIETOS, CALIFORNIA • ATLANTA, GEORGIA



SARAN LINED PIPE—only one short length replaced after 8 years and 500,000,000 acid gallons

These Saran Lined Pipes and valves have carried 8300 gal./hour of hot acid plating solution . . . 24 hours per day, six days per week, for eight years. If they fail, the cost of production downtime is $11,000 *per hour*. In the entire 400-foot line, only two valves and a ten-foot length of pipe have been replaced in the eight years!

This piping complex feeds acidic solutions from heat exchangers to plating tanks in a large automotive plant. The solutions are circulated day and night, keeping the tanks at a required 160° F. A break in the line could also cause complete loss of the tanks' contents—at a cost of $8000, not counting downtime.

At the time of installation, many types of corrosion-resistant pipe were tested. Saran Lined Pipe was chosen as the permanent transfer medium for this operation for several reasons: extreme resistance to corrosion . . . high strength, requiring minimum support for horizontal runs . . . easy cutting and fitting without special equipment.

Whenever dependable piping systems are needed for corrosive material, consider Saran Lined Pipe. Saran Lined Pipe, valves, fittings and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200° F. They can easily be cut, fitted and modified in the field without special equipment. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 1567CF10.

THE DOW CHEMICAL COMPANY DOW Midland, Michigan

Is there really a difference in Anodes?

You can bet your bottom dollar there's a difference!

It's based on the premise that, in an ideal plating bath, copper should dissolve evenly . . . ion-by-ion . . . and plate out evenly . . . ion-by-ion.

That's the kind of plating action you can get when you use OFHC® brand copper anodes. They give you maximum amounts of usable copper, reduced scrap, reduced sludge, and, most important, fewer rejected castings from rough plating.

Reason: OFHC anodes contain no dissolved oxygen or residual oxides. And because oxides are absent you are assured of orderly ion-by-ion dissolution even near the grain boundaries. You avoid premature release of small copper grains from the anode which either float to the cathode, causing roughness, or, if large enough, sink to the tank bottom as wasted copper.

In addition, the high, 99.99+% purity of OFHC anodes practically eliminates the insolubles that result in sludge. You not only reduce down time for sludge removal, you also reduce the possibility of the insolubles settling on the work to cause roughness.

Freedom from voids and porosity gives you further assurance of smooth plating.

Yes, there is a difference in anodes. Try an OFHC anode yourself and see. They are available in shapes to fit your needs . . . in any length up to 96 inches. Phone your OFHC Anode distributor or write to our AMCO Technical Service Department.

AMAX

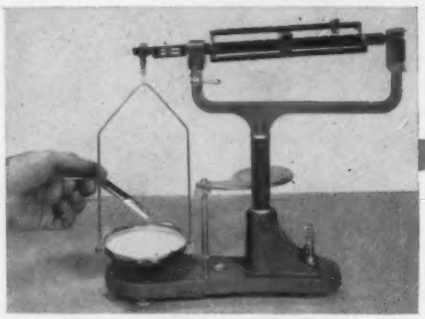
AMCO DIVISION

AMERICAN METAL CLIMAX, INC.

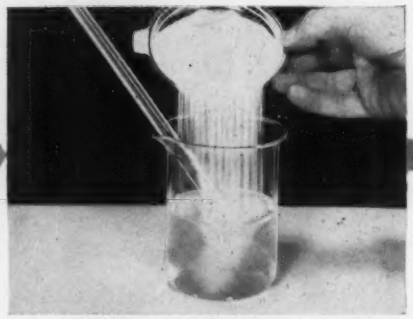
1270 Avenue of the Americas, New York 20, N.Y.

Here's how you can save time, and mixing errors with either

New "Direct-Route" Method



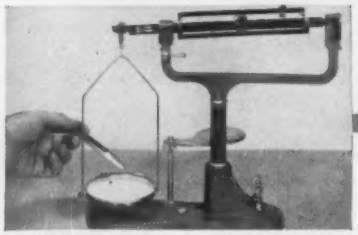
1 Just weigh required amount of sodium-copper or potassium-copper double salt.



2 Dissolve the desired double salt in water or plating solution.

Laboratory demonstration shows how "direct-route" method saves time

Old "Indirect" Method



1 Weigh out required amount of sodium or potassium cyanide.

2 Dissolve the sodium or potassium cyanide in water.

3 Weigh out the required amount of copper cyanide.

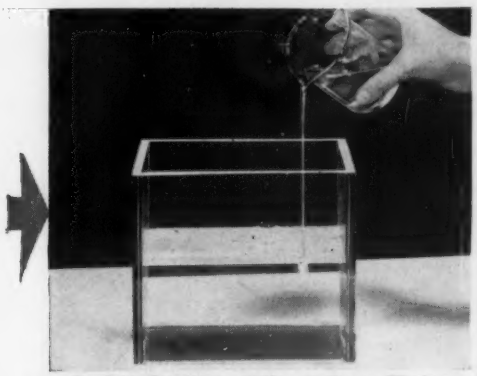
4 Add copper cyanide to water and make a slurry.

5 Dissolve the copper cyanide slurry in solution of sodium or potassium cyanide.

CALL DU PONT FOR ANY ONE OF THESE QUALITY PLATING PRODUCTS. You're assured of superior quality, dependable supply and expert technical service with plating chemicals from Du Pont... your reliable domestic source.

- **Sodium-Copper Cyanide Double Salt**
- **Potassium-Copper Cyanide Double Salt**
- **Copper Cyanide**
- **Potassium Cyanide**
- **All-purpose Cyanobrik® sodium cyanide (in briquette form)**
- **Cyanogran® M sodium cyanide (in granular form)**

reduce handling, avoid waste of Du Pont's Double Salts...



3 Add directly to plating tank—no filtering necessary.

...avoids errors.

6 Add solution through a filter to plating tank.

SODIUM-COPPER CYANIDE
OR
POTASSIUM-COPPER CYANIDE

SAVE TIME AND REDUCE HANDLING...By using one Du Pont copper cyanide double salt instead of two separate chemicals, you eliminate several steps usually required to dissolve copper cyanide. Just weigh out the Du Pont double salt and dissolve it in water or plating solution. A "direct-route" process! (Compare old and new methods at left.)

AVOID WASTE AND MIXING ERRORS...because active ingredients are in the proportions usually required. This simplifies making and replenishing bath . . . prevents waste resulting from undissolved copper cyanide.

INCREASE CONVENIENCE AND SAFETY...With just one salt to dissolve you minimize handling steps. This means greater convenience—more safety.

Du Pont sodium-copper cyanide double salt and potassium-copper cyanide double salt are white, crystalline and readily soluble. They are made from ingredients of highest quality and purity —Du Pont copper cyanide, sodium cyanide and potassium cyanide.

SIMPLIFY CALCULATIONS...Balanced composition of Du Pont double salts makes it easy to determine amounts required for make-up or replenishment. (1 oz. potassium-copper cyanide double salt is equivalent to 0.26 oz. copper, or 0.37 oz. copper cyanide; 1 oz. sodium-copper cyanide double salt is equivalent to 0.29 oz. copper or 0.41 oz. copper cyanide.)

SODIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	28.7% min.	29%
"Free" sodium cyanide	0.4 to 2.0%	1%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	0.01%

POTASSIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	25.8%	26.3%
"Free" potassium cyanide	1.25% to 3.0%	2.9%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	Trace

Both potassium and sodium double salts are shipped in convenient moisture-resistant 100-lb.-net fiber containers.

For further information or Technical Service call your Du Pont distributor or your nearest Du Pont office, listed at left.

ELECTROCHEMICALS DEPARTMENT • SODIUM PRODUCTS DIVISION
E. I. DU PONT DE NEMOURS & CO. (INC.), WILMINGTON 98, DELAWARE

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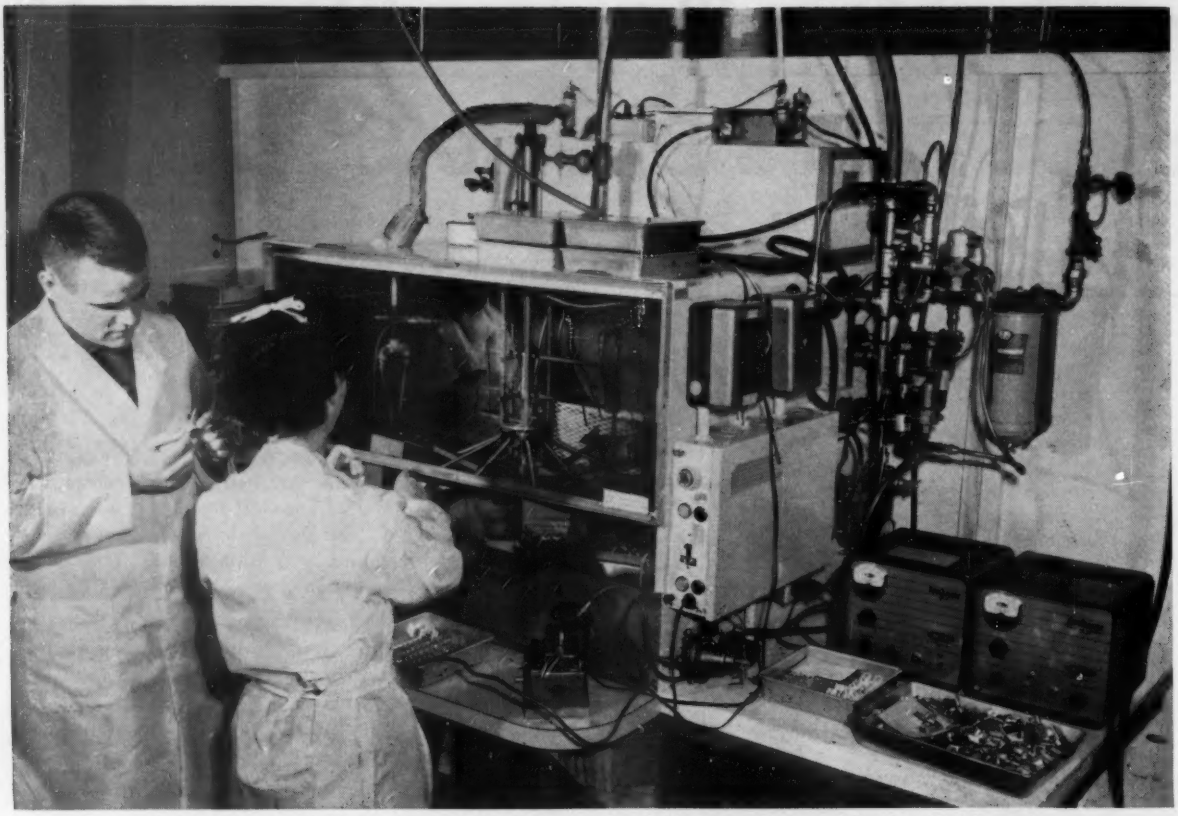
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



Charles Parke, production engineer at the Potter and Brumfield plant, a division of American Machine and Foundry Company, spot checks a part while operator removes remaining components from the cleaning system.

"WE MAGNIFY EACH PART 10 TIMES . . . DON'T FIND GREASE AFTER A NIALK® TRICHLOR BATH"

Workers handle delicate miniature relays with utmost care in Potter and Brumfield's "white room." Yet some contamination with dust and grease is inevitable.

"We assume everything is contaminated," continues Charles Parke, production engineer—and orders all of the minute parts cleaned with Nialk TRICHLORethylene.

100,000 parts between cleanouts.

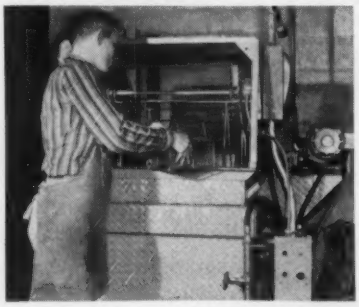
According to C. R. Stone, Director of Production, Nialk Trichlor removes the last bit of film on the metals. Potter and Brumfield degreases magnetic iron and nickel silver, running about 100,000 parts through between cleanouts.

They tried another vapor degreasing solvent, but "it didn't do the job Nialk Trichlor does. It wasn't distilling right and it wasn't doing the cleaning job."

Though much metal goes through every degreasing bath, this company doesn't have to titrate or run other tests.

Flush and vapor degrease—one trichlor

Potter and Brumfield uses one grade of trichlor for both flushing and vapor degreasing, considers this an important benefit.



And Mr. Stone concludes, "Hooker should get a large share of credit for the quality of parts produced by Potter and Brumfield."

You can get the same dependable cleaning with nonflammable Nialk TRICHLORethylene.

Hooker technical experts will help you set up your system. Then they'll check back with you regularly to make sure your flushing or degreasing operation stays trouble-free.

Talk to your Hooker Chemical distributor. He'll gladly help you with your problems and questions.

Or write us direct. We have years of experience to put at your disposal.

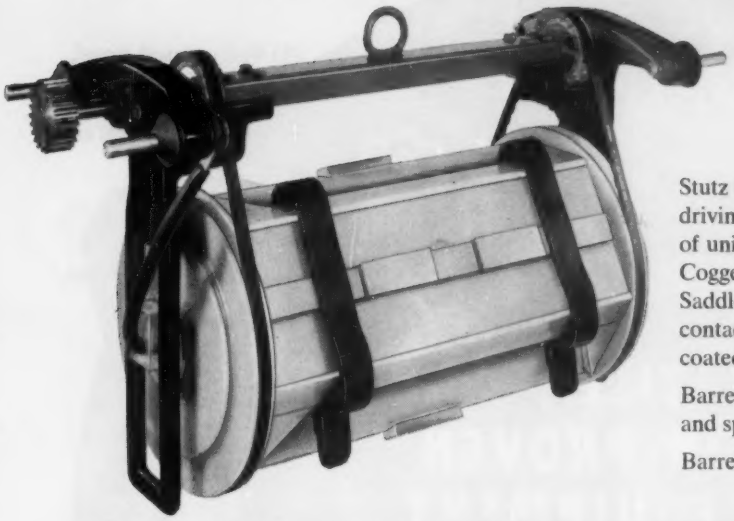
HOOKER CHEMICAL CORPORATION

1310 UNION STREET, NIAGARA FALLS, NEW YORK

HOOKER CHEMICALS PLASTICS

Sales offices: Buffalo, Chicago, Detroit, Los Angeles, New York, Niagara Falls, Philadelphia, Tacoma, Worcester, Mass. *In Canada:* Hooker Chemicals Limited, North Vancouver, B.C.

The NEW STUTZ Plating Barrels



ORIGINATOR OF

1. **LOW HEADROOM DESIGN**
2. **COMPLETELY COATED HANGER ARMS**
3. **QUICK CHANGE BELTS**

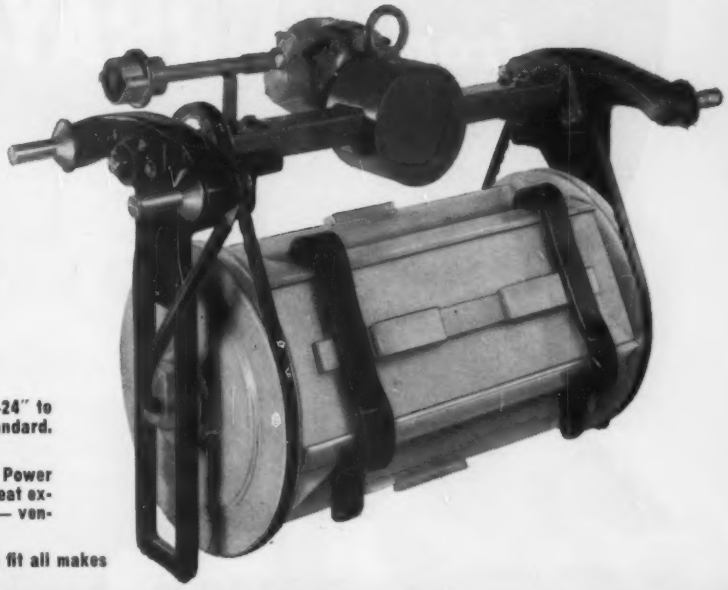
Stutz Complete Cycle Assembly for operation in tanks with driving mechanism located externally. Lifting and lowering of unit reduced to a minimum. Barrel is totally submerged. Cogged drive belts can be changed in seconds without tools. Saddle horns are 1" or 1¼" diameter. Cathode dangler type contacts are standard, with others available. Hanger arms coated with Vulcanized Hard Rubber or Rigid Plastisol.

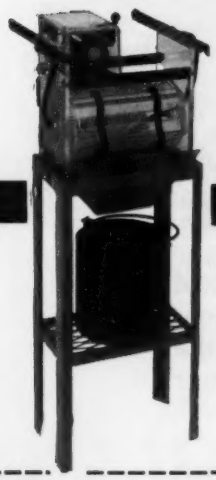
Barrels can be supplied in special sizes, also with partitions and special contacts as required.

Barrel assembly units are made to fit all makes of tanks.

. . . NEW MATERIALS • POLYPROPYLENE • PLEXIGLAS • TEMPRON • MELAMINE . . .

Barrel rotation in this design is provided by motor drive mounted directly in superstructure bridge member. Fast handling as total weight and overall height have been greatly reduced. Barrel transported from one operation to the next under continuous rotation. Solution dragout is reduced to a minimum. Rinsing time following alkali cleaning, acid pickling, etc., is greatly reduced. Overall dimensions of the tank are lessened by the elimination of motor drive platform. Electric service is 440, 220, or 115 volt with grounded cable and Hubbell-Twist Lock heavy duty safety connector.





Sizes 12" to 18" inside diameter—24" to 42" long—perforations 3/32" standard. All other sizes available.

Tanks in single and multiple — Power equipment — dryers — filters — heat exchangers — chemicals — anodes — ventilation, etc.

Barrel assembly units are made to fit all makes of tanks.

STUTZ *Portable Plating Barrels*

The Stutz Portable Barrel is made in 3 standard sizes with cylinders having inside dimensions of 6"x12", 8"x18" and 10"x20" I.D. Smaller upon application. Standard openings are 3/32". Smaller or larger openings can be furnished as required.

- **Baskets in perforated metals or wire mesh.**
- **Load/Unload Stand for convenient and fast handling of work load.**

Write for Catalog and Prices *We Invite your Inquiries*

The STUTZ Company

4430 West Carroll Ave. Chicago 24, Ill.

COMPLETE METAL FINISHING EQUIPMENT AND SUPPLIES

DIAL TABLE—built to fit your exact requirements.

#55 HEAD—compact, rugged, multi-position polishing and buffing head. Operates right or left.

VERSATILE "PRODUCTION-PROVEN" FINISHING EQUIPMENT *from* MURRAY-WAY

INDEXING CONVEYOR—incorporates exclusive Murray-Way indexing or continuous features.

EDGE GRINDER—for precision grinding of products such as floor tile.

Murray-Way offers a complete line of standardized, economical finishing equipment for both large and small shops. In addition, experienced Murray-Way production engineers, working with the finest manufacturing facilities available, will gladly help with your specialized production problems.

Write for detailed literature.

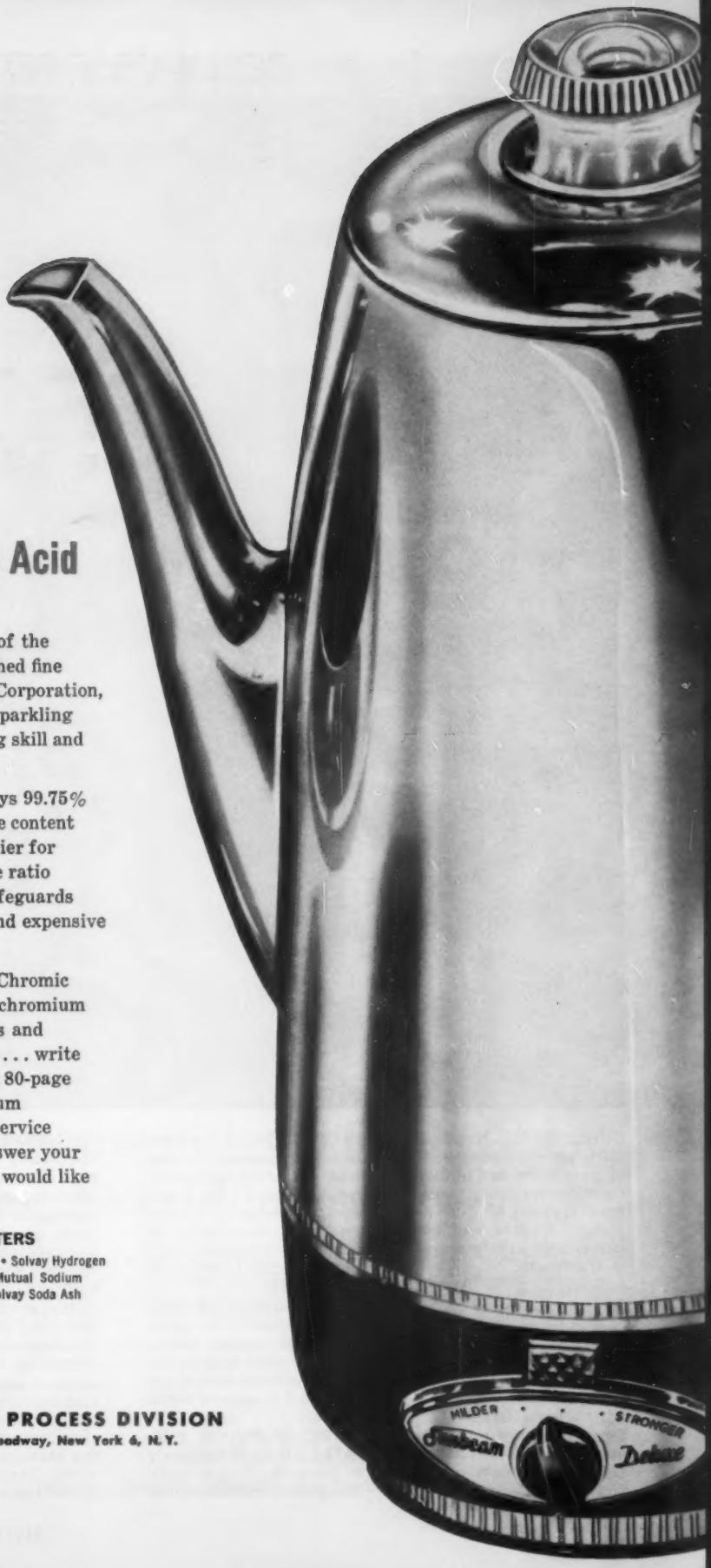
MURRAY WAY

MURRAY-WAY CORPORATION

P. O. BOX 180 • MAPLE RD. EAST
BIRMINGHAM, MICH.

Sunbeam

brightens any table with Mutual Chromic Acid



This Coffeemaster is typical of the handsomely and durably finished fine appliances made by Sunbeam Corporation, Chicago, Ill. They owe their sparkling good-looks to Sunbeam plating skill and Mutual® Chromic Acid.

Mutual Chromic Acid is always 99.75% pure—or better. Its low sulfate content (less than 0.1%) makes it easier for you to control the acid-sulfate ratio of your plating bath. This safeguards against plating difficulties—and expensive rejects!

To learn more about Mutual Chromic Acid and the Mutual line of chromium chemicals . . . uses, properties and comprehensive technical data . . . write for your free copy of Solvay's 80-page Technical Bulletin, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions. State whether you would like to have a representative call.

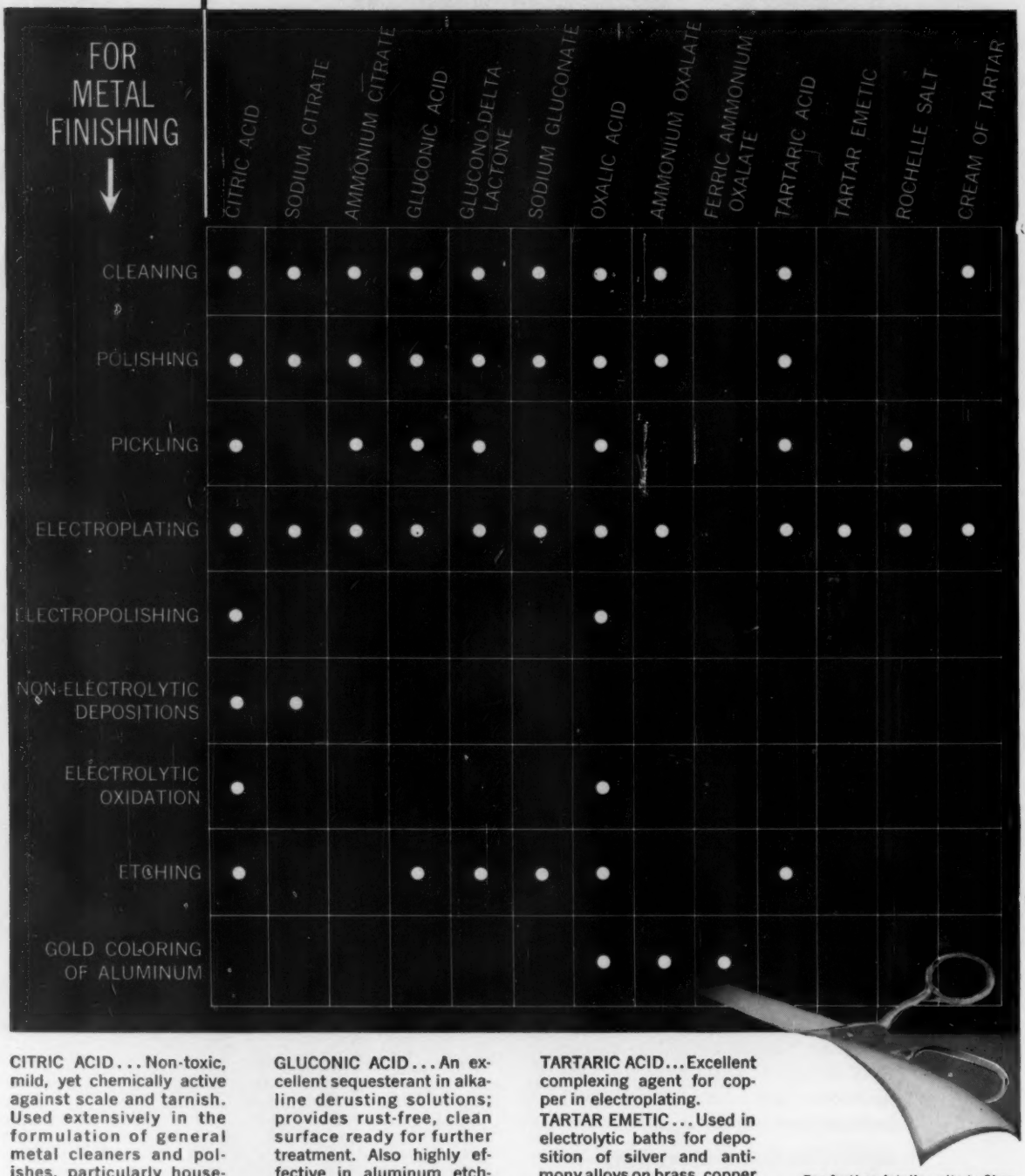
SOLVAY® PRODUCTS FOR PLATERS

Mutual Chromic Acid • Solvay Caustic Soda • Solvay Hydrogen Peroxide • Solvay Methylene Chloride • Mutual Sodium Chromate • Mutual Sodium Bichromate • Solvay Soda Ash

Allied Chemical

SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N.Y.

DEPENDABLE PFIZER® CHEMICALS



CITRIC ACID... Non-toxic, mild, yet chemically active against scale and tarnish. Used extensively in the formulation of general metal cleaners and polishes, particularly household products.

SODIUM CITRATE... A preferred ingredient in electroless nickel baths, resulting in a brighter plate. Also finds wide use in electroplating processes.

AMMONIUM CITRATE... Especially useful for the removal of rust in near neutral solutions. Extremely mild and safe to handle.

GLUCONIC ACID... An excellent sequesterant in alkaline derusting solutions; provides rust-free, clean surface ready for further treatment. Also highly effective in aluminum etching and paint stripping compounds.

OXALIC ACID... The most effective chemical for use in automobile radiator cleaners. Also finds wide use in electropolishing and as an ingredient in general metal cleaners.

FERRIC AMMONIUM OXALATE... Used extensively in the production of light-fast gold-colored aluminum.

TARTARIC ACID... Excellent complexing agent for copper in electroplating.

TARTAR EMETIC... Used in electrolytic baths for deposition of silver and antimony alloys on brass, copper and steel surfaces.

ROCHELLE SALT... Increases efficiency and yields finer-grain deposit in alkaline copperplating.

CREAM OF TARTAR... An excellent additive for brass and aluminum cleaning compounds. Its crystalline structure acts as an effective abrasive in paste polishes. Chemically active against tarnish.

For further details write to Chas. Pfizer & Co., Inc., Chemical Division, Brooklyn 6, New York.

Science for the world's well-being®

Pfizer

CHEMICAL DIVISION

Many a sale starts with the finish... when the finish is Nickel-Chrome Plating!

Notice how Nickel-Chrome Plating adds exciting sales appeal to quality appliances like these.

Many manufacturers have found that Nickel-Chrome Plating provides a *practical* way to boost sales because it assures a rich, distinctive eye-appeal at a reasonable manufacturing cost.

And your customers stay happy, too, because good Nickel-Chrome Plating—plating with a durable coat of Nickel under a thin layer of chromium—resists corrosion and wear, stains and scratches. That's why a Nickel-Chrome finish keeps its mirror-bright beauty through years of constant use.

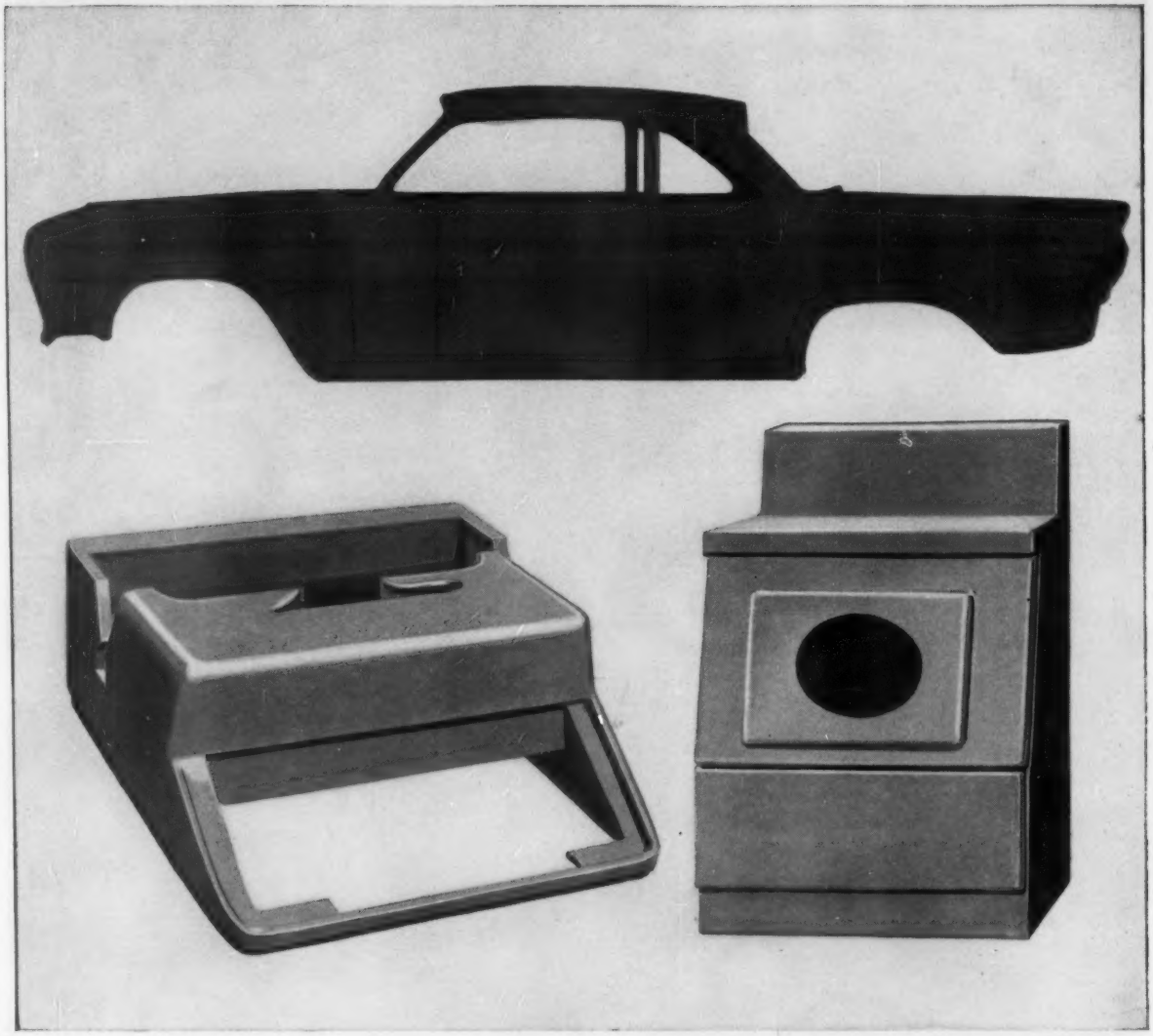
For up-to-date information on "how much and what kind" of Nickel and chromium provides various degrees of corrosion protection and luster, write for our booklet *The Contribution of Nickel and of Chromium to the Durability of Decorative Plating.* A copy is yours for the asking.

The International Nickel Company, Inc.
67 Wall Street INCO **New York 5, N. Y.**

Inco Nickel

Nickel makes plating perform better longer

What's News in Enjay Resins...



BUTON® Resins produce tough, low-cost primers!

Buton resins contribute to low-cost, long-lasting protective metal primers. Several inherent properties make them a natural choice for numerous metal priming applications. Buton resins possess excellent hardness, toughness, and flexibility . . . combined with outstanding resistance to such corrosive materials as: detergents, salt spray, boiling water, plus many acids and alkalis.

Buton resins offer excellent adhesion on most metals, including steel, galvanized steel, tin plate, aluminum, and various light metals. In addition, they provide good intercoat adhesion with conventional top coats. The initial low selling price, plus the high bulk of Buton resins make possible new savings in primer formulations. For more information, contact Enjay at 15 W. 51st St., N.Y. 19, N.Y.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

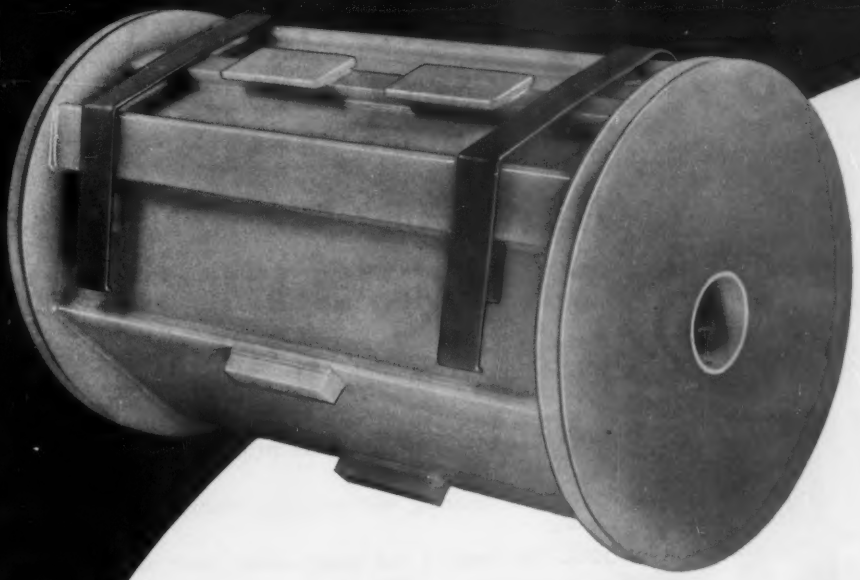
A DIVISION OF HUMBLE OIL & REFINING COMPANY

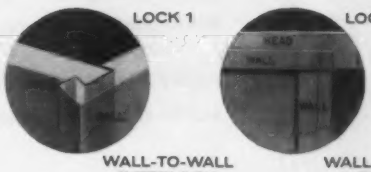
ENJAY

DOUBLE VALUE... DOUBLE SAVINGS

with the new

G-S LOCKWALL PLATING BARREL





Now— for the first time in the history of plating barrels you can get double savings!

The new G-S Lockwall Plating Barrels have interlocked and welded side walls that are also recessed and welded into the barrel heads.

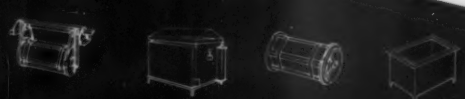
This super-strength barrel works *for you* in two ways to provide greater profits in your production:

FIRST — The G-S Lockwall costs considerably less than conventional barrels.

SECOND — They provide much longer trouble-free service life than standard designs.

These Plexiglas or Polypropylene barrels are furnished in all standard or custom sizes. The interlocking side panels are also available for G-S rebuilt units.

For more detailed information call or write Carel Neffenger at the Home Office.



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NOTICE! The proprietors wish to assure the readers that far from being old-fashioned, Northwest Chemical Company's continuing program of research and development keeps their products well ahead of industry's constantly changing requirements. Northwest's experienced Cleaning Specialists will gladly help you work out the best surface preparation for your product and "stand-by" to help keep it functioning at top efficiency.

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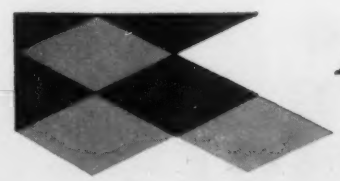

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TESTER

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UNITS

PERIODIC REVERSE UNITS are used with ALKALINE DERUSTING and DESCALING processes for more efficient and effective cleaning operations. **Write for Bulletin PR-AD-1.**

PERIODIC-REVERSE and CURRENT-INTERRUPTION UNITS—for PLATING of SILVER, COPPER, GOLD, BRASS, etc., this fine electronic equipment saves time, money and improves quality. It makes deposits smoother . . . faster . . . brighter . . . easier to polish . . . less porous . . . more uniform. And it's extremely simple to install and operate. **Write for current Bulletin PR-3 and prices.**

All requests for complete details are processed quickly.

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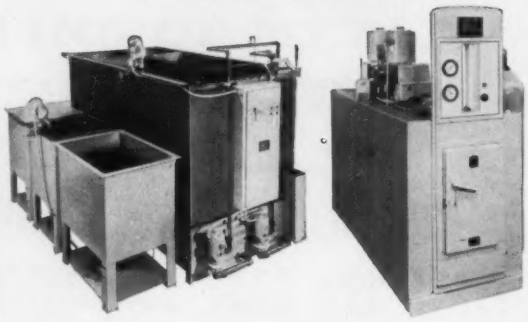
UPA

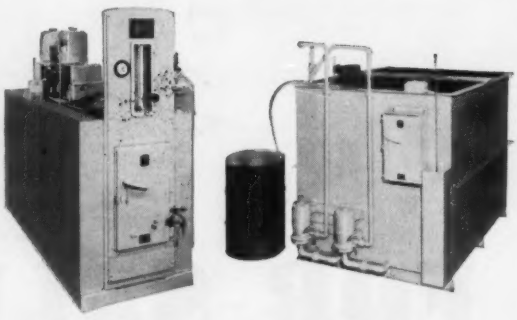
New PACKAGED Waste Treatment Equipment

for CHROME



Chromator Sulfonator

for CYANIDE



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Nankervis *packaged* waste treatment units are designed for the smaller plating plant—easily and inexpensively puts an end to waste treatment problems. Completely preassembled—easy to operate—needs no outside contractors for installation. Now in use in seven states—approved by Water Resource Commissions. For more information on costs, capacities, flow diagrams—write today. Sales and service representatives in principal cities.

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LEA

ABRASIVE FINISHING METHODS

PLASTICS

THERMOPLASTIC & THERMOSETTING

CASTINGS · MOLDINGS · THERMOFORMINGS · FABRICATION

Although most molded or cast plastic parts do not require buffing or polishing because of improvements in mold design, some do require removal of flash, parting lines, sprue projections, gates and imperfections from areas which may need further surface finishing. Articles cut and machined from cast or extruded sheets, rods, and tubes most generally need abrasive finishing to bring machined surfaces back to their original color using sanding, polishing, buffing and coloring operations.

SANDING...Heavy flash removal, sprues, flat surfacing and beveling on **thermosetting** and **thermoplastic** articles is usually done with wet belt sanding. Special waterproof abrasive belts are most generally used. Selection of grit size depends upon the thickness of the flash or sprue to be removed.

POLISHING OR WHEEL SANDING...On **thermosetting** plastic articles, flexible polishing wheels prepared with a coating of **Lea greaseless compound** provide a dry and resilient abrading face for removal of light or residual flash, surface imperfections, marks from cutting tools, and smoothing out irregularities on the contours left by belt sanding.

Thermoplastic articles which readily distort with frictional overheating must be handled with a minimum of pressure of the work against the **Lea Compound** coated buff and at lower peripheral speeds. Further insurance against overheating of the **thermoplastic** can be provided with a light top dressing of **Lubar** or **Learok** over the dried out head of **Lea Compound.**

ASHING...Wet ashing operations on **thermosetting** plastic articles have almost entirely been supplanted by flexible polishing with **Lea greaseless compound.**

Wet ashing operations in some cases are still necessary on **thermoplastic** articles, where a wet sanding belt or **Lea Compound** operation cannot touch areas with certain imperfections. Fundamentally, wet ashing is a dirty operation and parts must be washed and dried before they can be taken to subsequent buffing operations.

BUFFING...Buffing is usually divided into cut-down and lustre buffing or waxing. Cut-down buffing produces a semi-gloss finish from the dull, sanded surface resulting from belt sanding, the **Lea Compound** operation or wet ashing procedure. This semi-gloss finish is usually adequate as a final finish in some cases. Where a higher color is required, this cut-down buffing is the intermediate operation prior to the final high lustre buffing.

LEA ABRASIVE COMPOUND
RECOMMENDATIONS FOR PLASTIC FINISHING

OPERATION	THERMOPLASTIC	THERMOSETTING
Sanding	#50 to #400 grit Wet Belt	#50 to #400 grit Wet Belt preferred (May be dry)
Polishing or Wheel Sanding	Grade C or B31 Lea Compound. Dried out head lubricated with Lubar No. 4 or Learok 155.	Grade C or B31 Lea Compound. Lubrication may not be necessary.
Ashing	Grade C or B31 Lea Compound. Lubricate dried out head with Learok 155 or Lubar No. 4.	Grade C or B31 Lea Compound.
Satin Finishing	Grade R or S Lea Compound lubricated with Learok 155.	Grade FG or Q Lea Compound or other coarser grades.
Cut-Down	Learok 155, 765, 843, 855 or 857.	Learok 306, 307A or 857.
Cut & Color	Learok 304, 832 or 881.	Learok 304 or 882X.
Color	Learok 884 or 884E.	Learok 887E.
High Color	Learok 339 or 888.	Learok 339.

BUFFS AND PERIPHERAL SPEEDS

	THERMOPLASTIC	THERMOSETTING
BUFFS	For Polishing and Ashing...Contour of article and amount of plastic removal determines selection of buffing wheels to use in any of the following types—compress canvas wheel, sewed buff, ventilated or pocketed buff or loose buff. For Satin Finishing, Cut-Down, Cut & Color, Coloring and High Coloring Operations...selecting pocketed or ventilated type, sewed, loose muslin, packed muslin or canton flannel buffs, depends upon hardness of plastic, contour of the article and final finish desired.	
SPEEDS	3000 to 5000 surface	4000 to 6000 surface

PLASTIC LAMINATES

On surfaces of plastic laminates where fibrous fillers are completely covered with either a **thermoplastic** or **thermosetting** plastic, polishing and buffing recommendations are the same as given for the particular plastic binder involved.

When fibrous fillers are thoroughly impregnated, cut edges may be sanded, cut down and colored readily with the recommended compositions above. When the fibres of the filler are long, hard and not impregnated, i.e., fiberglass laminates—polishing operations on the edges with **Lea Compound** can be done successfully, but buffing to a high lustre is difficult because the long, hard fibres protrude and make it difficult to cut down and to produce a flat lustrous surface.

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc., 14459 Wildemere, Detroit 38, Mich.
Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
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Lea-Ronal, Inc. Main Office and Laboratory: 130-19 180th St., Jamaica 34, N. Y.
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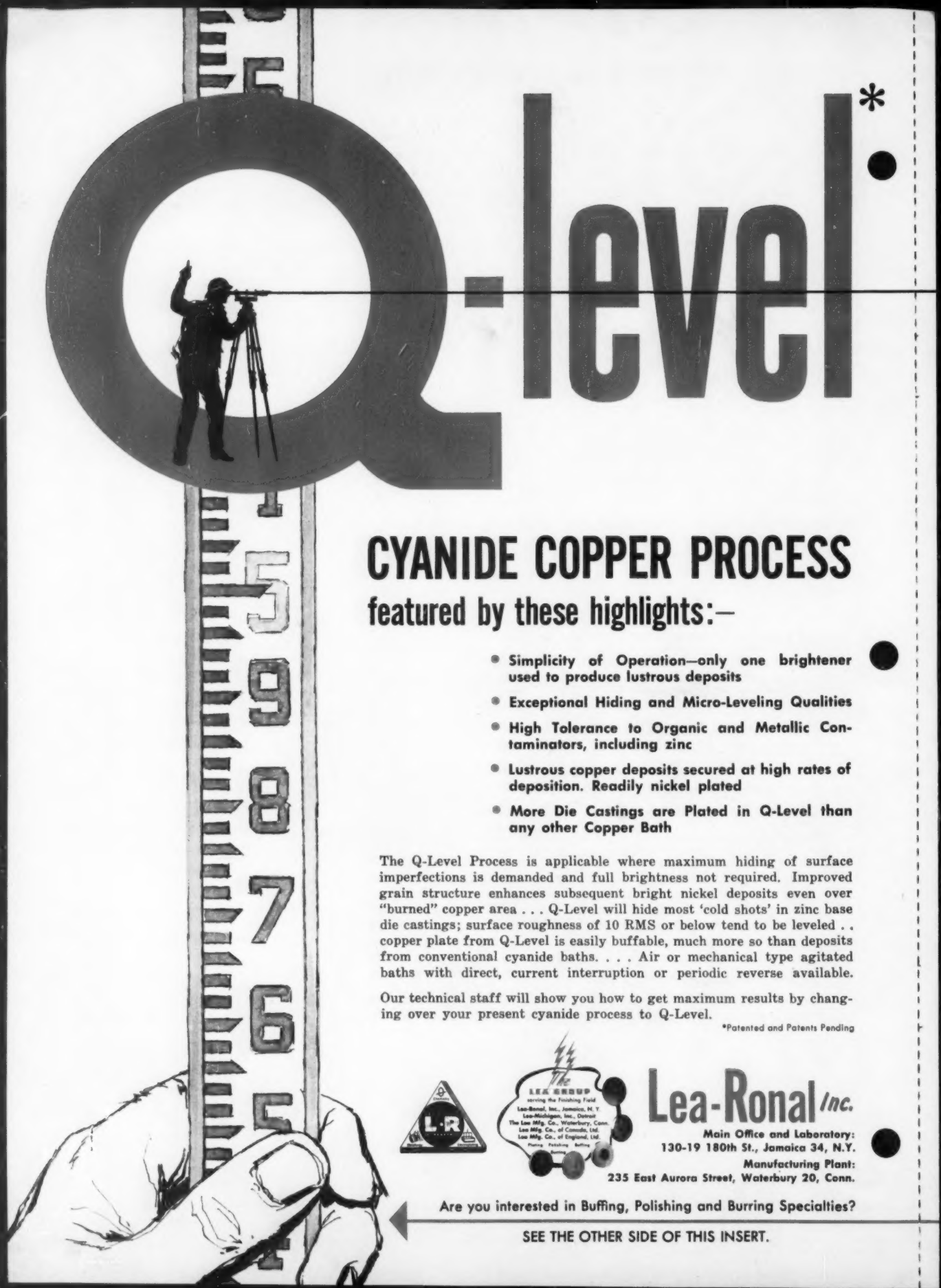
ABRASIVE FINISHING
PLASTIC
THERMOPLASTIC & THERMOSETTING



CYANIDE COPPER PROCESS

featured by these highlights:—

- **Simplicity of Operation—only one brightener used to produce lustrous deposits**
- **Exceptional Hiding and Micro-Leveling Qualities**
- **High Tolerance to Organic and Metallic Contaminators, including zinc**
- **Lustrous copper deposits secured at high rates of deposition. Readily nickel plated**
- **More Die Castings are Plated in Q-Level than any other Copper Bath**

The Q-Level Process is applicable where maximum hiding of surface imperfections is demanded and full brightness not required. Improved grain structure enhances subsequent bright nickel deposits even over "burned" copper area . . . Q-Level will hide most 'cold shots' in zinc base die castings; surface roughness of 10 RMS or below tend to be leveled . . copper plate from Q-Level is easily buffable, much more so than deposits from conventional cyanide baths. . . . Air or mechanical type agitated baths with direct, current interruption or periodic reverse available.

Our technical staff will show you how to get maximum results by changing over your present cyanide process to Q-Level.

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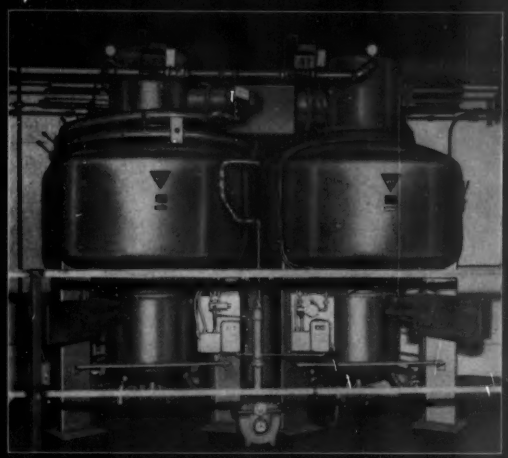
Announcing...

A "Meter Purchase Plan" for the

VIC VAPOR RECOVERY SYSTEM

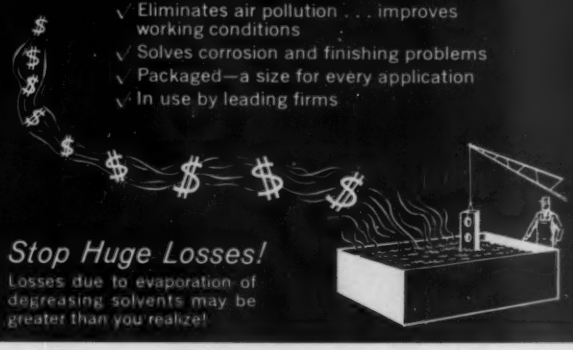


Installation at Superior Plating, Inc., Minneapolis, Minn., on overhead platform, takes minimum space.

Recover 50% or More of Losses Due to Evaporation with

THE VIC VAPOR RECOVERY SYSTEM

- √ Cuts Trichlorethylene costs
- √ Eliminates air pollution . . . improves working conditions
- √ Solves corrosion and finishing problems
- √ Packaged—a size for every application
- √ In use by leading firms



Stop Huge Losses!

Losses due to evaporation of degreasing solvents may be greater than you realize!

let the dollars it saves, pay for your Recovery System

Now—drastically reduce degreasing operation costs, eliminate air pollution *without* lump sum capital investment for vapor adsorber equipment! Install a Vic Vapor Recovery System; a meter measures volume of solvent recovered from evaporation. *Pay only a percentage of actual solvent recovered, calculated at your cost of new solvent.* On this basis, many firms realize sufficient savings to amortize the entire cost of the Recovery System the first year of operation! Better than a lease plan!

WHAT IS THE VIC VAPOR RECOVERY SYSTEM?

...A new, compact, *packaged* system for the recovery of reusable solvent from vapors normally exhausted outside or lost to the atmosphere in working areas. The Vic Vapor Recovery System has been thoroughly field tested on a number of actual installations. Users include such firms as Minneapolis-Honeywell Regulator Co., Micro Switch, Superior Plating, Inc., Colorado Fuel & Iron, Great Northern Railway, General Electric Co. and the Gray Co. The Vic Vapor Recovery System is endorsed by leading solvent manufacturers.

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Please send complete details on the Vic Vapor Recovery System and Meter Purchase Plan.

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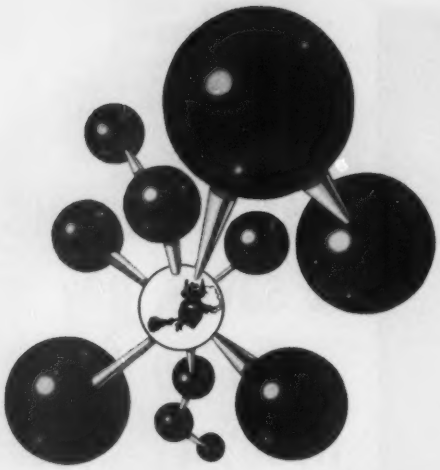

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BLACK MAGIC
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When you use "Activated" Black Magic you get the following advantages:

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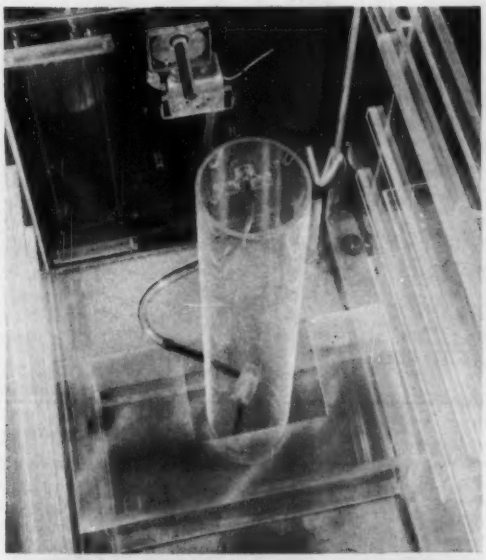

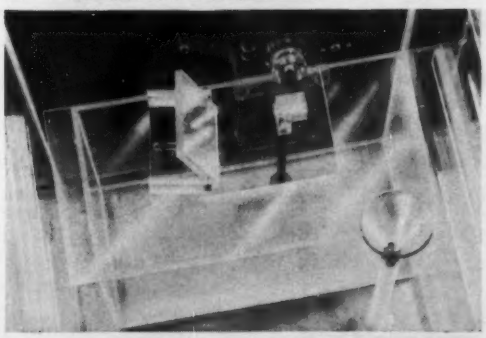

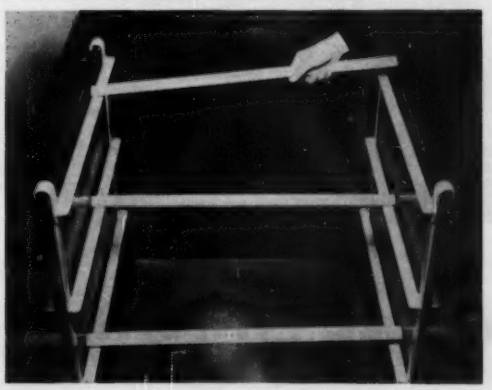

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Today it's **"mandatory"** corrosion testing — Salt Fog, Humidity, Acetic Acid, Corrodkote, Cass Tests. To meet tighter specifications, your fog cabinet must be designed and built to provide **specified conditions** for **optimum results.** Only one stands out for "nearest to 100% uniform accuracy of test results" — **Singleton.**

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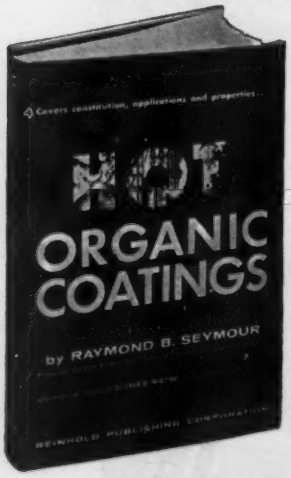
HOT ORGANIC COATINGS

by RAYMOND B. SEYMOUR
President, Alcylite Plastic and Chemical Corporation
With a special chapter by GEORGE B. McCOMB
Consultant to Suppliers of Pipe Line Coatings

1959, 244 pages, $7.50

The constitution, applications and properties of hot organic protective coatings are concisely presented here. The book contains chapters on widely used hot organic materials such as asphalt, coal-tar pitch, petroleum waxes and cellulose derivatives. Specific information on formulations of proprietary products is included. Additional chapters deal with hot melt applications without solvent such as peel coatings, protective linings, flame spraying and the fluidized bed process. One chapter on hot applied coal tar pitch base coatings is supplied by George B. McComb, consultant to the leading suppliers of pipe line coatings. Hot spray techniques and the many advantages of this application are also covered. This book will be helpful to everyone using these coatings in any form.



CONTENTS:

Coating Fundamentals
General Discussion of Hot Coatings
Asphalt and Related Products
Coal Tar Pitch
Petroleum Waxes
Synthetic Hydrocarbon Resins
Cellulose Derivatives
Animal, Vegetable & Insect Waxes
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Index

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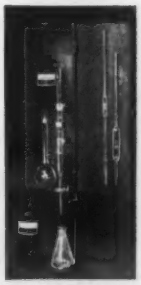

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- Sulfates
- Trivalent chromium
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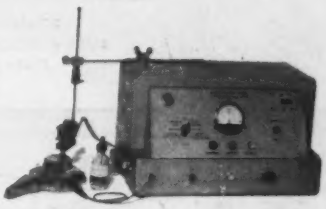

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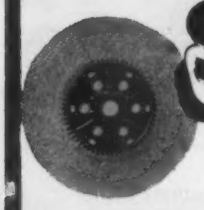

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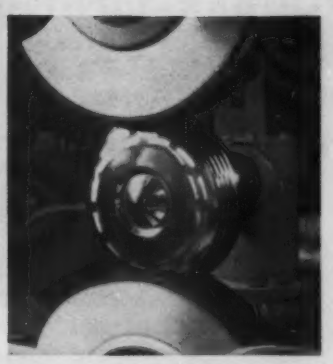

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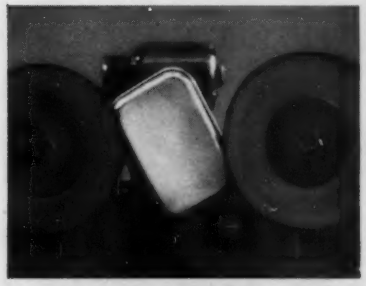

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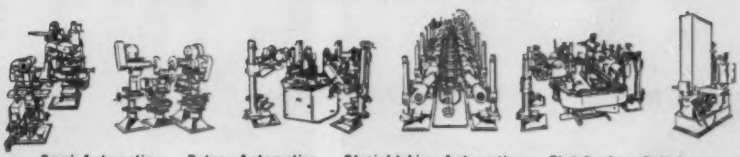

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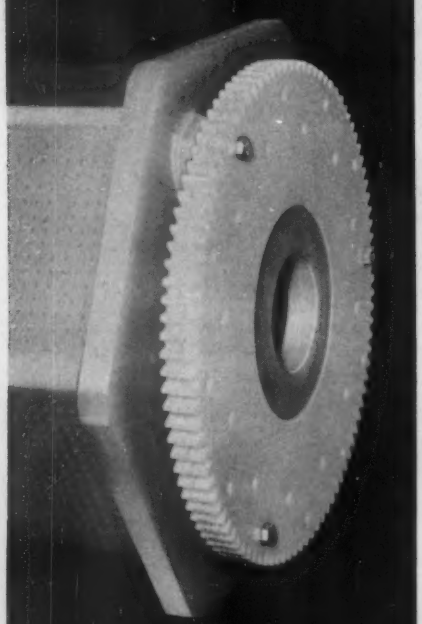

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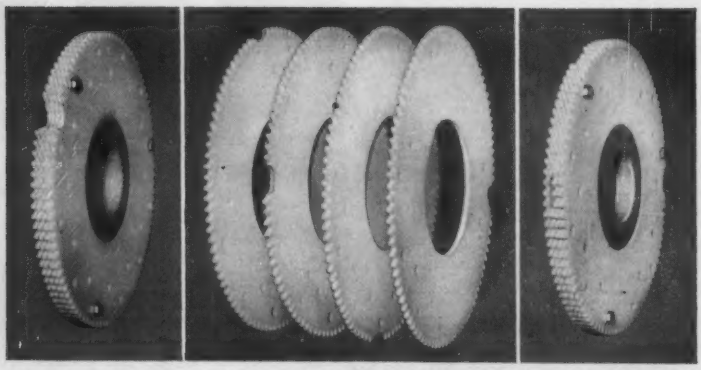

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OCTOBER, 1961 Volume 59 No. 10

FEATURES

Editorial — "Hard" Anodizing 53

Control in Aluminum Anodizing 54
By J. M. Kape

Metal Rustproofing Patent Decisions 61
By Howard Newcomb Morse

Finishing Procedures for Magnesium and Magnesium Base Alloys 63
By Lester F. Spencer

New Methods of Determination of Adhesion and Fatigue Strength of Electrodeposited Antifrictional Coatings 67
By Larissa Domnikov

Synthetic Resins — Part XI 71
By Harold P. Preuss

Volumetric Determination of Zinc and Copper in Brass Plating Solutions 75
By J. R. Luck and E. H. Lindemann

Science for Electroplaters — Part LXVIII 76
By L. Serota

National Metal Show Preview 101A-B

DEPARTMENTS

Shop Problems	79	Manufacturers' Literature	95
Professional Directory	80	New Books	98
Patents	81	Business Items	101
Foreign Literature	83	News from California	112
Recent Developments	86	Associations and Societies	115

Obituaries 115

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"HARD" ANODIZING

Thirty years ago, someone gave the name "hard" chromium to thick deposits for industrial use, although they were really no harder than the thin coatings deposited for ornamental purposes, and the name has since served only to confuse and mislead those unfamiliar with finishing terminology. It is unfortunate that the new methods developed in the last few years for producing thick anodic oxide films on aluminum and its alloys have been saddled with the same meaningless adjective, because the confusion is being compounded. This is not intended to be a lesson in semantics. The terms "hard" chromium and "hard" anodizing are already pretty well established in the lexicon of metal finishing terms, and this editor will follow the precept of Confucius and accept the inevitable. But, not without at least one mild protest against the apparently passive acquiescence with which our industry is willing to adopt the characterizations of overenthusiastic publicity seekers.

If a hard film, less than about one mil thick, is required on aluminum, there is no reason for the user to specify any particular type of anodizing. On the other hand, if thicker oxide coatings are specified, he can be sure he will get so-called "hard" anodizing. Therefore, a thickness specification, without further qualification, will satisfy all requirements, insuring the proper finish and avoiding complications for the anodizer. However, it cannot be emphasized too strongly that the engineer must be aware not only of the advantages of thick oxide coatings but their limitations, if he is to avoid unnecessary cost and possibly spoiled parts.

Half of the oxide film thickness is growth. Since thicknesses up to 0.010" are obtainable, thick anodizing provides an effective salvage method for overmachined parts. At the same time, due to the excellent throwing power inherent in anodizing, a 10 mil film will also reduce the bore of a drilled hole by about the same amount. Thus, unless allowance is made prior to anodizing, or the anodizer is told to plug drilled or tapped holes, reaming or retapping may be necessary — and, let us not forget, the material is somewhat harder than chromium. Films produced on some copper and silicon alloys do not have maximum abrasion and corrosion resistance. In most cases there is a very significant decrease in fatigue life. Films do not build up satisfactorily on edges and tend to crumble, while surface roughening may necessitate honing or grinding after anodizing.

Pitfalls lie in the path of the aluminum fabricator who feels it must be better because it is the latest thing, or who thinks that specifying "hard" anodizing demonstrates his competence in the field and will impress the finisher. He would do better to consider the process carefully and then discuss his needs with the anodizer.

Nathaniel Hall

Control in Aluminum Anodizing

Processes and Coatings

By J. M. Kape, *Metal Finishing Section, Aluminium Laboratories Ltd., Banbury, England*

Control of Pretreatment Processes

THE caustic soda etch solution is usually 5-10% by weight of commercial flake in water, operated at 60-70°C. and is controlled by titration with standard acid. A large amount of aluminum can be tolerated in solution, and large differences in free caustic soda do not materially affect the properties of the final finish, although slight variations in surface appearance may be seen.

The bright etch solution, usually composed of 75% H_3PO_4 + 25% H_2SO_4 by volume (alternatively, 66% H_3PO_4 + 33% H_2SO_4 by volume) operated at 105-110°C. for 2-10 minutes depending on the brightness required, is not frequently checked analytically unless used continuously. It is necessary to rapidly rinse the viscous acids away from the surface with hot water after immersion in this brightener. Large quantities of aluminum can be tolerated in solution without affecting the finish materially, and the aluminum content usually reaches an equilibrium value after a certain time has elapsed, the acid concentration being maintained by regular additions. In any case, analytical control of this type of solution is quite a tedious process, involving determination of phosphate by the gravimetric or volumetric ammonium molybdate method, and determination of sulfate using the gravimetric barium sulfate method.

Control of the chemical brightener is most important. There are two types of chemical brightener popularly used in Britain. One contains mainly phosphoric acid-sulphuric acid, with nitric acid and an addition of copper. The other contains the same, but with some of the phosphoric acid and sulphuric acid replaced with acetic acid. Since the former bath is the most commonly used, the following discussion is concerned with the control of this solution. The optimum temperature is around 105°C. and most alloys are best treated at this temperature. The nitric acid is of great importance in the operation of this bath. Obviously a lot of nitric acid will evaporate, and more will be consumed during brightening (work is usually immersed for one to two minutes). It has been found that, relative to the aluminum content of the solution, there is an optimum working range of nitric acid. It is sufficient to realize that the aluminum content reaches an equilibrium maintained by drag-out during brightening and replenishment of the solution.[1] At this equilibrium value, with commercially pure materials, 4-5% of nitric acid is suitable. Stains are associated with too low a nitric acid content, and an etched appearance will result if the nitric acid is too high.

Electrobrightening is often most cheaply carried out utilizing an electrolyte containing 4-6% of trisodium phosphate with either 15, 20 or 25% of carbonate;[3] 20% of carbonate often proves to be the most convenient level to work at. A temperature of 80°C. is usual with a potential of 15 volts applied. After brightening, work should be desmudged in a phosphoric-nitric dip, prior to anodizing. Details of the operation of all the popularly used brightening processes have been described in a paper by Brace[4] and it is not proposed to deal with them here.

The daily chemical control of the electrobrightening type solutions is of great importance, and is rather tedious if done by conventional methods,[2] i.e. determination of total alkalinity by titration, determination of phosphate by the phosphomolybdic acid method, and subtraction of one result from the other to obtain the carbonate figure. This means that the phosphate determination is of necessity carried out first, as this result is used for the determination of carbonate. In commercial practice it is found that the carbonate is consumed at a greater rate than phosphate and, hence, it is important to check carbonate content at more regular intervals than phosphate (a suitable rough workshop method is given in the appendix). The aluminum content appears mainly as sludge, and should be kept at a minimum by continuous pumping of the electrolyte through a suitable filter.

Control of Anodizing Processes

(A) SULFURIC ACID PROCESSES:

These are usually operated at 70-75°F., using 2.5N to 4.5N acid, with 12-15 amp./ft.^{2} at 12-18 V. Solutions are usually air agitated. If the temperature of the solution rises much above 80°F. soft, powdery coatings will result, and local patchy, soft areas will be obtained if the agitation is insufficient.

Suitable titration methods for control are described in the literature,[5] and always involve the determination of three factors:—

(1) Total acidity
(2) Free acidity
(3) Aluminum content

Naturally, in a new anodizing solution (1) = (2) and in a used solution (1) — (2) = combined acidity. The free acidity is usually the most important thing to determine, as it has been shown that the presence of even large amounts of aluminum (i.e. a high combined acid content) do not materially affect

the properties of the sulfuric acid coating in service. When the aluminum content of the bath reaches approximately 20 g./l. it should be discarded, although commercial anodizing solutions will operate at considerably higher levels of aluminum than this and, in fact, have been used satisfactorily until crystals of aluminum sulphate have precipitated out.

One of the most popular methods of workshop control, if a pH meter is not available, is first to titrate an aliquot of the anodizing solution with standard caustic soda using phenolphthalein as indicator; this gives the total acid. To a second aliquot is added a given volume of potassium fluoride which complexes the aluminum as potassium aluminum fluoride, hence, rendering the combined acid untitratable. A second titration then reveals the free acid.

If a pH meter is available, all three variables may be determined together by a potentiometric titration, using a glass electrode.[6] The method used is described in full in the appendix.

It is not often realized that the aluminum build-up in a sulfuric acid electrolyte results from two causes:

(1) Solution of *aluminum* into the electrolyte resulting from the reaction:

$$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$$

(2) Solution of *aluminum oxide* (anodic film) according to the reaction:

$$Al_2O_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2O$$

Reaction (1) occurs owing to the fact that aluminum is not completely converted to its oxide as one would expect from Faraday's Law [i.e. the passage of a coulomb of electricity results in the liberation of one gram equivalent of Al (9 g.), but these 9 g. are not changed entirely to oxide by combination with oxygen liberated at the anode].

Reaction (2) occurs as the film grows, owing to the inherent chemical solubility of aluminum oxide, composing the anodic film, in the sulphuric acid.

It follows that, like most chemical reactions, (1) and (2) can be slowed down considerably by lowering the temperature and, in fact, considering the hard anodizing operation, anodizing solutions may last considerably longer before the necessity arises to discard them, since they are operated at 0°C. or below.

Excess chloride (over 2 g./l.) can cause pitting during anodizing, and may easily be estimated by precipitation of silver chloride with silver nitrate and nitric acid, and weighing.

(B) CHROMIC ACID PROCESSES:

These are usually operated at 3-10% by weight CrO_3, at 40-55°C. and 30-40V (3-12 amp./ft.^{2}).

Similarly to the sulfuric acid process, it is necessary to determine total chromic acid and free chromic acid, from which combined chromic acid may be calculated. A simple method of control, again using a pH meter and glass electrode, is described in the appendix.

A 3% solution of *free* chromic acid will work satisfactorily up to a level of 10% *total* chromic acid. At this point patchy coatings often result, and occasionally the opacity of the film suffers. Similarly, a 10% free chromic acid solution operates satisfactorily up to around 20% total acid content when the same troubles occur. The sulfate content of chromic acid anodizing solutions is critical, and about 0.2-0.3% SO_4 is necessary to give the best opacity. This is lost completely if pure (analytical grade) CrO_3 is used, or if about 0.5-1.0% H_2SO_4 is present. Sulfate can be removed to a certain degree from a chromic acid electrolyte if barium hydroxide solution is added. Estimation of the sulfate content can be made by reducing a known volume of the chromic acid electrolyte to trivalent chromium and precipitating the sulphate with barium chloride.

Control of Dyeing Processes

Most dyestuffs are used in concentrations of 0.2-10 g./l. (with the exception of Nigrosine Black at 30 g./l.), and pH's ranging from 3-8 (usually 5.5-6.5). Temperatures recommended are often 50-60°C.; some dyes may be used cold. If available, the manufacturers' recommendations are best observed.

Since the most important controlling factor to observe when using dyestuffs is the pH, then Table I is a guide. Too acid a dyestuff causes patchiness and powdering of the outer layers of the anodic film, too alkaline dyes do not color the film properly, and attack the coating.

TABLE I

If dye is on alkaline side		*If dye is on the acid side*	
ml. of 0.1N H_2SO_4 used per 200 ml. sample	*ml. of conc. commercially pure H_2SO_4 to add per gallon of dye solution*	*ml. of 0.1N NaOH used per 200 ml. sample*	*gm. of solid commercially pure NaOH to add per gallon of dye solution*
1	0.053	1	0.0757
2	0.106	2	0.1514
3	0.159	3	0.2271
4	0.212	4	0.3028
5	0.265	5	0.3785

The concentration of the dyestuff, fortunately, is not quite as crucial a criterion of its operation as the pH, and is best adjusted by means of a colorimeter. If one of these is not available, it is necessary to take a sample of the freshly made dye, dilute it by adding 490 ml. water to 10 ml. (or 495 ml. to 5 ml. if a black dye is being checked) and do likewise to the production dyestuff. Usually the production dye is weaker than the standard, and a certain volume of water has to be added to the standard to make the colors match. (It should be pointed out that it is best to preserve a quantity of the freshly made production dye as the standard, as certain dyes change color slightly after a time.)

The original volume and final volume of the standard are noted. Then $\frac{\text{original volume of standard}}{\text{final volume of standard}} \times$ specified concentration = concentration of dye solution. Amount of solid dye required = (specified concentration — found concentration) × number of gallons.

Control of Sealing Processes

It is necessary first of all to consider the types of sealing methods used in production. These may be one or two of three main types:

(1) Boiling water, pH 5.5-7.5.

(2) 0.5% nickel acetate, pH 5.5-6.5, 80°C.

(3) Boiling 5% sodium or potassium dichromate, pH 5.5-6.5.

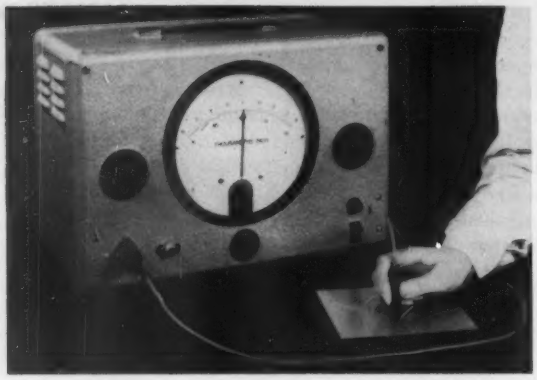

Fig. 1. Isometer for measuring anodic film thickness. The probe rests on the anodized panel and the film thickness is read off on the dial.

(1) is used for undyed work; (2) for dyed work, followed usually by (1); (3) for providing extra corrosion resistance, usually on undyed work.

Anodized and undyed material is usually immersed into solutions (1) or (3) for 10-30 minutes, depending on the thickness of the anodic film, and dyed materials (not all colors) are immersed into (2) for 2-3 minutes, then into (1) for a period depending on anodic film thickness.

The efficiency of the boiling water seal is very dependent on changes in pH, and acid carry-over from the sulfuric acid anodizing solutions can ruin it. Furthermore, the temperature of the sealing water must be kept at boiling point, otherwise efficient sealing is not obtained. It is preferable, although not essential, that the water used is of a fairly high purity, as certain foreign ions (i.e. chloride, fluoride, silicate and phosphate) may cause poor sealing. If a source of deionized or distilled water is available, it is preferable to use it.

Control of the pH of the sealing water should be carried out several times daily, either with pH papers or with the pH meter.

The nickel acetate sealing solution is effective from concentrations of 0.2-1.0% nickel acetate. Below 0.2% concentration, or if the pH is wrong or temperature below 70°C., color will be leached out of dyed anodized work. The nickel acetate concentration is easily checked by a further potentiometric method using the glass electrode, and titrating with a dilute solution of ethylene diamine tetra acetic acid, EDTA. The method is detailed in the appendix.

The dichromate sealing process is one of the simplest to use in production as, provided the temperature is between 95 and 100°C. and the concentration between 1 and 5% at pH 5.5-6.5, the sealing process operates very efficiently.

Testing Anodic Coatings

When produced by the methods described previously, the quality of the anodized surface should be quite high. There are, however, distinct possibilities of bad practice in any one operation. It is necessary, therefore, to test the quality of the anodic film very carefully, bearing in mind the service which it will meet.

THICKNESS:

Properties such as corrosion resistance and abrasion resistance of all anodic coatings are partly dependent on the film thickness.

(a) *Destructive*

(1) *Stripping*: Anodic films are completely removed, without attack on the metal, by immersion in a solution containing 3.5% by volume phosphoric acid (sp.g. 1.75) and 2.0% by weight chromic acid, used at the boiling point. The area of the component whose thickness is required is measured accurately and the component is weighed before and after immersion in the chromic acid-phosphoric acid mixture. The thickness is calculated by use of the formula:

$$T\ (\text{microns}) = \frac{\text{weight loss} \times 10}{\text{area of coating in cm.}^2 \times 2.7}$$

(2) *Microscopic*: The anodized specimen is mounted between spacers. It is best to make a "sandwich" of pieces of the sample of annealed aluminum sheet which is held together by two nuts and bolts. Samples of castings are best mounted in plastic with a backing-up of aluminum sheet against the coated surface. Polishing of the transverse section is carried out as follows:—

(a) File, rub with 0, 00 and 000 emery paper in that order.

(b) Polish on rotating disc revolving at about 300 r.p.m. using kittens ear cloth pad and 600 aluminum oxide flour.

(c) Finally polish on rotating disc at 150 r.p.m. Use heavy MgO and kittens ear cloth.

The mounted and polished specimens are examined under the microscope.

(b) *Non-destructive*

A description of non-destructive electronic instruments for measurement of film thickness has been given elsewhere,[7] and will not be described here in detail. A suitable instrument is shown in Fig. 1. The probe contains a test coil which is fed with an alternating current. When the probe is placed on the flat surface of the anodized component induced currents are set up in the metal. This gives rise to a change of impedance of the coil, depending on its separation from the surface and, hence, on the thickness of the anodic coating. The method is susceptible to the effect of surface roughness and, for example, erroneous readings can result on sand-blasted surfaces. Any curvature also exercises a pronounced effect, and it is impossible to obtain an accurate reading even on a surface of slight curvature. It is always preferable to calibrate the instrument on a surface of the same alloy to be measured in the same condition of pretreatment.

REFLECTIVITY:

For motor car trim, certain domestic ware and lighting fixtures, it is a matter of some importance to have the correct type of reflectivity, or to have a

certain minimum acceptable reflectivity relative to the material and processing conditions. For reflectors, super-purity or alloys based on this material are essential[8] to obtain high specular reflectivity, and this measurement is frequently carried out using a suitable instrument,[9] but most other applications rely on determination of the "image clarity" as a yardstick of suitability.

A screen of tracing paper is prepared with a grid of black bands marked out on it, as shown in Fig. 2. The grid is illuminated by a light source behind it and the bright anodized item placed in front of the grid. The operator walks away from the grid until the lines are no longer resolvable in the reflected image. The distance of the operator from the grid is measured and this is proportional to the image clarity. The method has the advantage of simplicity, and is also capable of measuring the image clarity of curved surfaces.

ABRASION RESISTANCE:

For certain exterior applications it is important to know the resistance of an anodic finish to dust and sand abrasion. For a hard anodic film, the measurement of abrasion resistance is of importance in revealing the difference between coatings which have been properly produced and those which are softer than that which is acceptable.

Abrasion resistance may be tested by an apparatus due to Schuh and Kern[10] as shown in Fig. 3. A jet of abrasive is propelled by an air blast, at a controlled flow rate as measured by a flow meter, on to the specimen inclined at 45°. The weight of abrasive to penetrate the coating is noted, and is usually expressed in grams of abrasive/micron film thickness. Table II shows that the hardness of the coating and its abrasion resistance are basically different, and gives the amount of material worn away by the grit (expressed as the volume of coating removed by 1 kg. of grit) and the Vickers diamond pyramid hardness number of the surface.

The design of the jet has been altered dimensionally since Schuh and Kern originally published the method, and a completely new specification of the instrument is to appear in the next revision of BS.1615 "Anodic Oxidation Finishes."[11]

TABLE II

Surface material	*Mean loss of volume ml./kg. of grit*	*V.P.N. approx.*
Hard anodized, pure aluminum	0.0049	450
Untreated, pure aluminum	0.0029	35
Mild steel	0.0022	200
Vitreous enameled aluminum	0.0450	377

DYEING:

The light-fastness of dyestuffs is of vital importance as far as their durability for architectural purposes is concerned. Unfortunately, there is no quick method of assessment; by far the best method is natural exposure in the environment for which their use is contemplated. Certain publications[12,13] have laid down good practice methods of architectural anodizing, and it is best at the present state of knowledge to follow their recommendations.

Very often the fading-resistance of certain anodized aluminum colors is assessed by exposure to an artificial source of light, in a "Fadeometer," "Weatherometer," or some other such apparatus. The anodized colors are subjected to artificial light from carbon arcs, mercury vapor lamps, or any other suitable

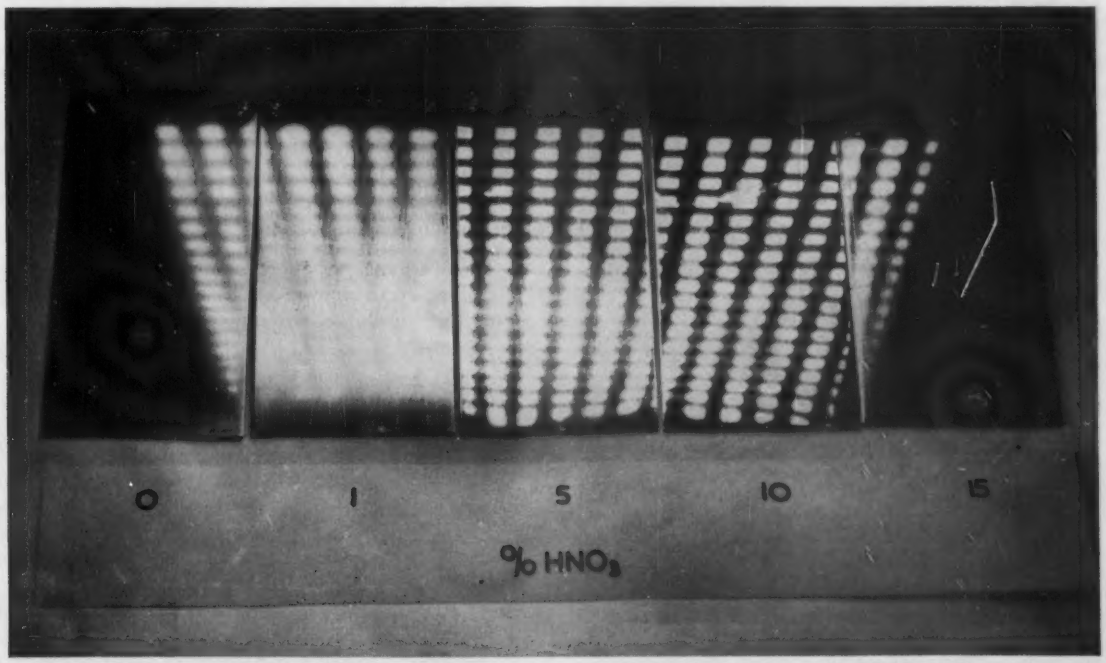

Fig. 2. Reflected image of the grid squares in the bright anodized panels. The panels were produced in phosbrite 159 at various nitric acid contents. The 10% nitric acid content obviously produces the best image clarity on this alloy.

source of light. Fading of the colors is assessed by comparison with the fading of known dyed textile fabrics,[14] rated Nos. 1-8, where 1 is very bad and 8 very good. If the anodized color shows a change in shade about the same time as fabric 5 has faded, then it is rated '5'. More recently the Society of Dyers and Colourists has introduced a method of assessment of fading using a neutral grey scale of color contrasts. This is a card containing 5 contrasted pairs of tones, one of the pair being a constant grey shade, the other decreasing in intensity, 5 being no contrast, and 1 being a very large contrast on a geometric scale. By the use of the grey scale the actual rate of fading of a particular color can be traced, and the method has the distinct advantage that it can be used for outdoor exposure where dyes of high durability commence to fade a long time after textile standard 8 has been bleached completely. It should be pointed out that accelerated tests, although usually indicating dyes which will be very good for outdoor exposure, may also cause fading of dyes which do not change color to a great extent out-of-doors. This is due to the fact that certain dyestuffs are very sensitve to certain wavelengths of light, and these wavelengths may be present predominantly in the carbon or mercury vapor arc. Recently, a xenon lamp has been considered as a source of radiation, more comparable to natural sunlight, and the author's laboratory has obtained reasonable comparative results wtih outdoor exposure using the xenon lamp as a light source.

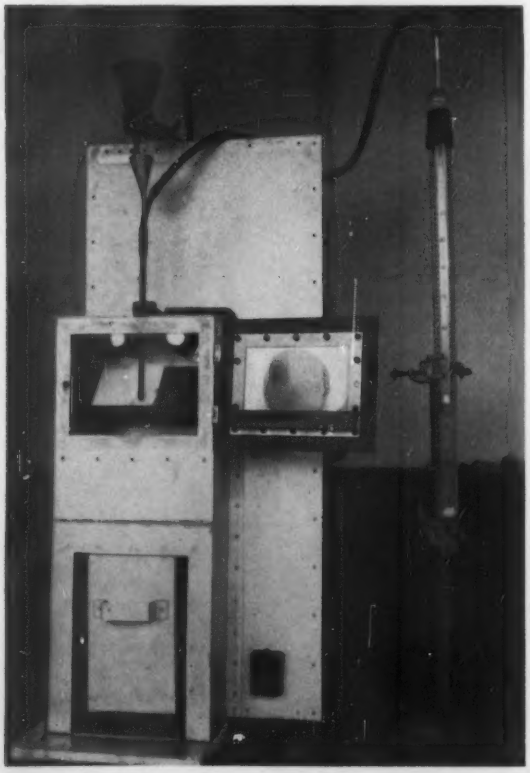

Fig. 3. Abrasion test apparatus. The flow meter on the right controls the supply of air which blows silicon carbide grit from the hopper on the top left of the apparatus on to the specimen inclined at 45°. The grit is collected in the base of the apparatus.

SEALING AND CORROSION RESISTANCE:

Since this section covers one of the most important characteristics of anodic films, and, since to obtain optimum corrosion resistance it is essential to seal properly, these two properties will be considered together.

In recent years, there has been a great deal of conflict concerning methods of testing anodic films for efficiency of sealing and overall corrosion resistance. Of necessity, most tests evaluating corrosion resistance reveal whether a coating has been sealed properly or not, whereas, tests of the sealing efficiency will reveal only whether the sealing has been carried out properly — and hence only give an indication of one aspect on the overall performance from the point of view of corrosion resistance.

Tests have been developed, owing to demands of the consumer aluminum industry, to check both the sealing and corrosion resistance of the system aluminum-anodic film.[7] So far, vapor SO_2 tests for sealing have been found to give results which compare favorably with outdoor exposure tests, and a coating, if improperly or inadequately sealed, develops a white haze or bloom either in the test or outdoors. Naturally, such tests are designed only to attack the aluminum oxide of which the coating is composed, and are based on the proven principle that böhmite formed in quantity during correct sealing, is chemically resistant to sulfuric fumes, while absence of böhmite lowers this resistance, resulting in chemical attack on the outer layers of the coating, giving a white haze or bloom.

A typical sealing test has been described by the writer,[15] and is useful as a workshop control test for the elucidation of sealing efficiency. It consists of immersion of the panels in a hot solution of sodium sulfite which is buffered to pH 2.5 by addition of acetic acid and sulfuric acid. This solution generates sulfur dioxide in situ, which is somewhat soluble in acetic acid and remains in solution long enough to attack the surface of insufficiently or improperly sealed material, revealing this as a white surface bloom. Fig. 4 shows bright anodized panels which have been correctly and incorrectly sealed after testing in both the solution and vapor[7] SO_2 tests.

These sealing tests, however, do not indicate the overall protective power of the anodic film-metal system. They do not wholly indicate:

(1) The effect of the basis metal.

(2) The effect of thickness of the anodic film.

(3) The effect of quality of the anodic film (i.e. the manner in which it has been produced) prior to sealing.

At the moment, there have been several types of corrosion tests proposed which are listed below.

(1) *Salt immersion tests*:

(a) intermittent immersion in 5% solution of sodium chloride,

(b) continuous immersion in 5% solution of sodium chloride.

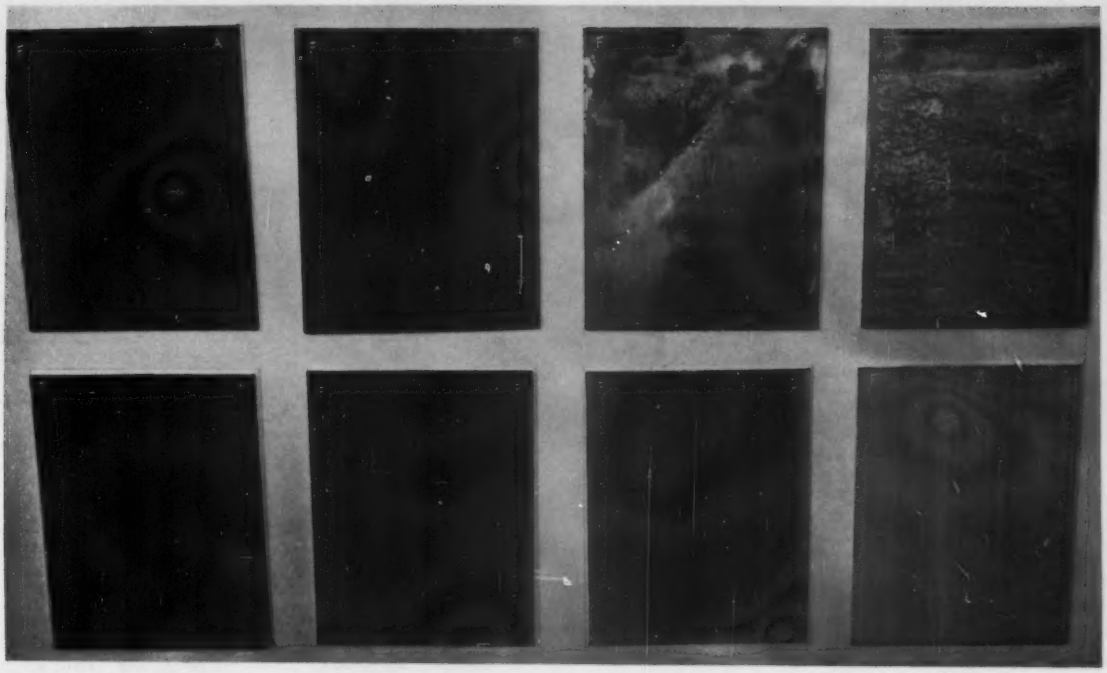

Fig. 4. Sealed 10 μ bright anodized panels which have been exposed to SO_2 vapor for 24 hours (top row) and to the SO_2 solution test for 20 minutes (bottom row). The panels were sealed (left to right) in boiling deionized water, boiling Banbury tap water, deionized water at 80°C., boiling deionized water pH 4.

(2) *Salt-spray tests*:

(a) 3% salt-spray test.

(b) 20% neutral salt-spray test.[16]

(c) 2.5% sodium chloride, 1.5% acetic acid. 0.1% hydrogen peroxide spray.[17]

(d) 5% sodium chloride—1% acetic acid fog, pH 3.2-3.5, 95°F.[18]

(e) Copper acetic acid—5% salt spray (C.A. S.S. test).[19]

The salt immersion tests and, in fact, any test utilizing merely salt, suffer from the usual criticism that they take a very long time to get results and, when these become available, it is doubtful if they mean much in relation to natural outdoor exposure, with perhaps the exception of a marine site. The main reason for this is that chloride attacks the basis metal through pores in the anodic film, and has no effect on the anodic film itself. Therefore, all that these tests measure is the corrosion of the basis metal at odd places (weak spots) in the anodic film. Some attack of the film can occur if acetic acid is incorporated into the spray, thus rendering the solution slightly acid and of constant pH (in intermittent or continuous immersion tests the pH alters with time). Brace and Pocock[7] found that poor sealing was revealed by the test (c) used at 78°F. and 80% relative humidity. The difficulty with the test had subsequently been found to be that it is not very reproducible, particularly on thicker coatings and, like all salt-spray chamber tests, the intensity of corrosion varies with the positions of the specimens in the test cabinet relative to the intensity of corrosive fog or condensate.

The method of assessment of the amount of corrosion is not very well defined in test (c). Either the time taken to produce a certain amount of corrosion (i.e. 1% of the total area of the test panel) or the time taken to initiation of pitting can be taken as the parameter; but, neither are entirely satisfactory without taking into account the type and depth of corrosion.

Despite all these drawbacks the method is frequently used to evaluate the corrosion resistance of anodic coatings.

MISCELLANEOUS TESTS:

Amongst other properties of anodic films which are often required to be evaluated are certain electrical properties such as breakdown voltage, resistance, and capacitance. The measurement of breakdown voltage has been standardized in B.S.1615: 1958, Appendix 6, p. 31. The drawback with the method is that it is sensitive to humidity variations and, once the test has been carried out, black "scorch marks" are left on the surface of the component.

With respect to other properties, i.e. resistance to specific chemicals, it is always safer actually to carry out specific tests to elucidate the resistance of anodic films. For example, the resistance of anodized domestic holloware to detergents, of anodized aluminum trays to tea and coffee, and fountain pens and pencil bodies to perspiration, are all best determined under actual service conditions. Other examples for consideration are the specific wearing properties (i.e. rubbing with or without lubricant) or scratch resistance of hard anodic films, and the corrosive properties of certain mortars, putties, and cements on architectural anodized components.

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Appendix

SODIUM HYDROXIDE AND TOTAL ALKALINITY OF CAUSTIC ETCHING BATH:

Pipette 5 ml. of the etching solution into the 200 ml. beaker and dilute to approximately 100 ml. Add 1.0N H_2SO_4 or HCl 0.5 ml. at a time, taking the pH after each addition. Continue the additions until the pH falls to above 5.

Plot a graph of pH versus ml. of standard acid and determine the mid-point of the two inflections. The first inflection occurs at about pH 11 and corresponds to the titration of free sodium hydroxide; the second, at approximately pH 8 occurs at the completion of precipitation of aluminum hydroxide from sodium aluminate.

The results are calculated as follows:—

$$\text{Free sodium hydroxide } \% = \frac{\text{ml. N acid to first end-point} \times 4}{5}$$

$$\text{Total alkali, as } \% \text{ NaOH} = \frac{\text{ml. N acid to second end-point} \times 4}{5}$$

Aluminum content of bath, gm./l. = (ml. to second end-point — ml. to first end point) × 5.4

NITRIC ACID IN PHOSPHORIC ACID BASE CHEMICAL BRIGHTENING SOLUTIONS:

Reagents:

Ferrous sulfate solution: Add 50 ml. concentrated sulfuric acid to 700 ml. distilled water and dissolve in it 265 gm. $FeSO_4 \cdot 7H_2O$. Cool the solution and make up to 1 liter. Standardize every week.

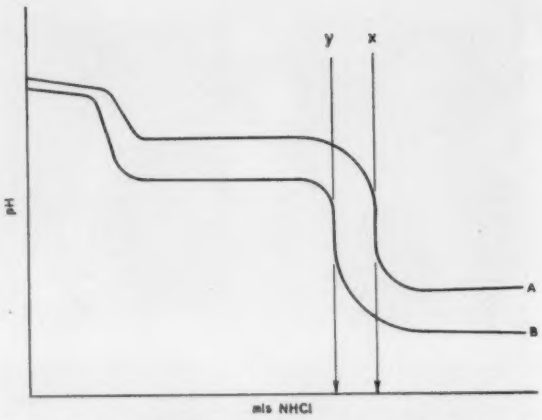


Fig. 5. Titration of sodium carbonate (B) and sodium carbonate — trisodium phosphate mixture (A) with 1.0 N HCl.

Phosphoric acid: Pure grade, S.G. 1.75.

Potassium dichromate: Dissolve 24.515 g. $K_2Cr_2O_7$ in distilled water and make up to 1 liter. This gives a N/2 solution.

Potassium ferricyanide indicator: Wash a small crystal (approximately 0.5 g.) into a few ml. distilled water, then dissolve in 50 ml. distilled water.

Standardization of the Ferrous Sulfate solution:

Titrate 25 ml. of N/2 potassium dichromate solution with the ferrous sulfate solution. Place several drops of potassium ferricyanide indicator on a spot plate; at intervals remove a drop of the solution being titrated and mix it with a drop of ferricyanide. The end point is reached when a bluish-green color is produced when the drops are mixed.

Procedure:

Measure accurately 5 ml. of the polishing solution and put into a dry 250-ml. beaker. A burette is preferable for measuring the solution. Add 100 ml. phosphoric acid, stir and heat to 40°-50°C. (104°-122°F.). Titrate with ferrous sulfate until the first permanent golden-brown color is formed. Towards the end of the titration the acid boils locally with each addition of ferrous sulfate and reddish-yellow fumes are evolved. (At the end point no fumes are evolved.)

Let x be the number of ml. of ferrous sulfate solution used to titrate against potassium dichromate.

Let y be the number of ml. of ferrous sulfate solution required to neutralize the sample.

Then % HNO_3 (70%) present (by volume) = $(y/x) \times 5.3$.

CARBONATE IN ELECTROBRIGHTENING SOLUTION:

For quick routine checking of carbonate it is best to make up a solution of 5% trisodium phosphate (anhydrous) and 20% anhydrous sodium carbonate, and potentiometrically titrate this mixture with 1.0N hydrochloric acid, using a glass electrode. A curve will

(*Continued on page* 62)

Metal Rustproofing Patent Decisions

By Howard Newcomb Morse, *Counsellor at Law of the Supreme Court of the United States of America*

JOHN S. THOMPSON filed suit in the District Court of the United States for the District of Columbia to compel Conway P. Coe, Commissioner of Patents, to issue him a patent for a process of rustproofing metal. The court decided that nothing in the description of the rustproofing process in Thompson's application for a patent recited anything amounting to invention and, therefore, rendered judgment in favor of Coe. Thompson appealed.

The application for a patent described the rustproofing process as follows:

"In the rustproofing of metallic objects by subjecting the same to the action of an aqueous solution of rustproofing material, the step of applying water to the object prior to immersion in the rustproofing solution and breaking down the surface tension of the water by mechanical means to effect a complete wetting of the surface of the object immediately prior to the rustproofing step whereby said solution will immediately attack the entire surface of the object with substantially equal intensity.

"In the rustproofing of metallic objects by subjecting them to the action of an aqueous solution of rustproofing compound, and the employment of rolls in the preparation of the object for the rustproofing step, the step of subjecting said object to a squeezing operation between said rolls in the presence of water whereby said rolls break down the surface tension of said water and completely wet the surface of the same for reception of the rustproofing solution, and then immediately subjecting said wetted surface to said aqueous solution of rustproofing compound.

"The use of rolls in the rustproofing of metallic objects by the action of an aqueous solution of rustproofing compound, the step of subjecting the object to a squeezing action between said rolls in the presence of water to effect a complete wetting of the surface of the object preliminary to the action of said rustproofing compound thereon, and then subjecting said object to the action of said aqueous solution of rustproofing compound while said surface remains completely wetted."

The United States Court of Appeals for the District of Columbia affirmed the decision of the court below. The United States Court of Appeals declared: "It is obvious, we think, that there is nothing . . . which approaches the dignity of invention. Conceding the utility of . . . (Thompson's) process, nevertheless, in developing it, he accomplished no more than a skilled mechanic should have been expected reasonably to do . . . Whatever may be the characteristics of that flash of genius which is required to justify the granting of a patent, it certainly is not present here."

High-Acid Orthophosphate

In another case, Matthew Green and Elmer M. Jones made application for a patent. The claim in the application read as follows: "A rustproofing compound, comprising a granular or powdery substance containing high acid orthophosphates of iron."

The application related to a method of making a rustproofing composition and included both process and product claims. Certain of the process claims were allowed, but the product claim, being that above quoted, was rejected by the Examiner of Patents, and Green and Jones appealed. The Board of Appeals of the United States Patent Office sustained the decision of the Examiner, and Green and Jones again appealed.

The specification disclosed that the composition was used by dissolving it in water. In the specification it was stated: "When strong phosphoric acid contacts iron, high acid salts are formed. Weaker acid, or the acid salts, in contact with iron form the lower acid and insoluble salts." The solution was then boiled and articles having iron surfaces were immersed in it while the solution was boiling.

If the claim was patentable, it was because it constituted invention to produce high acid orthophosphates of iron in a granular or powdery form. The Solicitor for the Patent Office contended that: "Claim . . . enumerates only one element — a well-known chemical product resulting from treating iron with phosphoric acid — in a granular or powdery form. It is submitted to be uninventive to powder any substance."

Green and Jones made the following statement: "Ordinary commercial phosphoric acid has the formula H_3PO_4. It combines readily with iron in at least three ways indicated in the following equations:

"$Fe + 2H_3PO_4 = Fe(H_2PO_4)_2 + 2H$. *The product*

of this reaction is commonly known as dihydrogen ferrous phosphate.

"$3Fe + 2H_3PO_4 = Fe_3(PO_4)_2 + 6H$. The product of this reaction is normal ferrous phosphate.

"Each of these phosphates is normally crystalline. However, the dihydrogen phosphate is readily soluble in water, the monohydrogen phosphate is practically insoluble, its solubility being in terms of a small fraction of 1%; and the normal ferrous phosphate is even less soluble than the monohydrogen phosphate.

"In applicants' (Green's and Jones') process iron and acid are mixed together in the proper proportion to form dihydrogen ferrous phosphate. This is the phosphate first formed when phosphoric acid attacks iron, at least when the phosphoric acid is present in sufficient quantity."

Low-Acid Orthophosphate

An existing and outstanding patent, known as the Emig patent, clearly disclosed a product of low acid orthophosphates of iron, and it was obvious from that disclosure that high acid orthophosphates of iron would be produced by reducing the percentage of iron filings employed in the combination with phosphoric acid.

The Emig patent stated:

"My invention relates to a coating material for iron and the like which is strongly adherent, durable and weatherproof and will protect the surface of iron, etc., to which it is applied for a very extended period from the action of the air and other oxidizing influences. In the following specification I have described in detail the preferred ingredients and proportions thereof and also the preferred manner of compounding the ingredients so as to secure the most satisfactory composition for the purpose. It is to be understood, however, that the specific disclosure is for the purpose of exemplification and that my invention in its broader aspect is not limited either to the particular ingredients, proportions or method of compounding specifically described but equivalent materials may be used, the proportions and the method of compounding varied without departing from the scope of the invention as set forth in the following claims."

The Court of Customs and Patent Appeals upheld the decision of the Board of Appeals. The Court stated: "We agree with the Board of Appeals that there would be no invention in omitting the added ingredients disclosed by Emig and using the iron filings and phosphoric acid to produce the product described in . . . claim . . . There is nothing in the record from which we could conclude that it constituted invention to reduce high acid orthophosphates of iron to a granular or powdery form."

CONTROL OF ALUMINUM ANODIZING

(*Continued from page* 60)

result as shown in Fig. 6 and the second neutralization peak on the curve A (see Fig. 5) is primarily due to the reaction $NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$, although there is a certain amount of interference from phosphate and CO_2. This interference can be eliminated by titration of 20% sodium carbonate alone, when curve B will result and the difference in the two titrations (x - y) ml. HCl is equivalent to the error due to interference of CO_2 and PO_4 (about 15%). Once the error is known and is taken into account, the carbonate content of the brightening solution can be rapidly checked and controlled within ±1%, which is good enough for commercial applications of the process.

POTENTIOMETRIC METHOD FOR SULPHURIC ACID BATH:

Pipette 5 ml. of the electrolyte into a 400 ml. beaker and dilute to approximately 200 ml. Insert the electrode of the pH meter and titrate with 1.0N sodium hydroxide solution to pH 3.6, stirring continuously. Record this as 'A'. Continue titrating to pH 10.0: record this as 'C'.

Then ml. $A \times N \times 9.80 =$ g./l. H_2SO_4

ml. $(C - A) \times N \times 1.35 =$ g./l. Aluminum

CHROMIC ACID BATH:

25 ml. of the electrolyte are measured out into a 200 ml. beaker and 100 ml. of water added from a graduated cylinder. The solution is then titrated against 1.0N caustic soda with stirring, first to pH 3.2 and then to pH 4.8. The amount of alkali to bring the solution to these two pH's is noted. Denote these as (a) ml. and (b) ml. respectively.

Free CrO_3, % $= 0.4 \times$ (a)

Total CrO_3, % $= 0.4 \times$ (b)

Al_2O_3 content, % $= 0.68$ (b) $- 0.694$ (a)

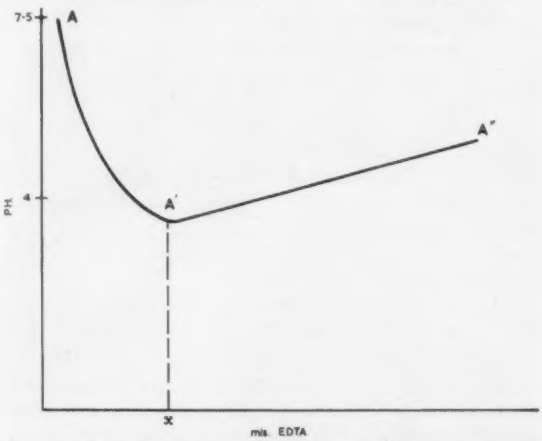


Fig. 6. Titration of nickel acetate sealing solution with ethylene diamine tetra acetic acid solution.

NICKEL ACETATE SEALING BATH:

25 ml. of the nickel acetate solution are pipetted into a 200 ml. beaker and 100 ml. of water added. A 50 g./l. EDTA solution is added from the burette at 0.5 cc. intervals and the pH of the mixture taken after swirling the solution in the beaker. A graph of pH versus ml. EDTA added is plotted and resembles Fig. 6. The end point is x, between the two different types of curve AA' and A'A", around pH 4.

If (x) ml. of EDTA are required, then % nickel acetate [as $Ni(CH_3COO)_2 \cdot 4H_2O$] $= 0.126$(x).

Finishing Procedures for Magnesium and Magnesium Base Alloys

By Lester F. Spencer, *Finishing Engineer, Cleveland, Ohio*

This is the second installment of a three-part article on magnesium alloys. The first part appeared in the September issue. All references will be listed with the third installment.—*Ed.*

ELECTROPLATING on magnesium-base alloys is generally considered as a more expensive method of surface protection as compared to other finishing systems. However, when properly processed, it will provide a surface exhibiting excellent corrosion and wear resistance. As compared to electroplating on other light metals, i.e., aluminum, it is essential that greater attention be paid to both solution and process control, in order to obtain predictable and consistently high quality electrodeposits.

The more widely used process is that developed by Dow[5] which generally consists of five basic steps, namely: (a) surface conditioning, (b) activating pickling, (c) zinc immersion coating, (d) copper strike, and finally, (e) plating from standard plating baths. The plate thickness will vary with the intended service, ranging from 0.00075″ for interior applications to 0.002″ for severe exterior applications.

The more widely used procedures to determine the quality of an electrodeposit are an adhesion test and salt spray testing. The adhesion test[1,2] consists of heating the part to about 500°F. The bond strength should be sufficient to withstand the stress caused by dissimiliar metal expansion, as well as the stress induced by hydrogen adsorbed during the plating cycle. Blistering of the surface indicates that the proper adhesion has not been realized. The ability of an electroplated coating to withstand even higher temperatures has been cited.[2] It had been stated that wrought products have withstood heating to 1100 to 1200°F. without general lifting or blistering of a deposit, while castings can be plated to withstand heating up to 700°F. One advantage of the heat test is that it is a simple, effective method that is non-destructive, inexpensive, and convenient,[1] particularly where 100% testing of the parts is required. The salt spray test is also a standard acceptance test and, as with electrodeposits on other basis metals, the degree of resistance is a function of the coating thickness.

Surface Conditioning

When a smooth and highly polished surface is required, it is recommended that the parts be polished and buffed. The procedure employed is very similar to that used for the aluminum-base alloys, with the exception that certain magnesium alloys, being appreciably harder, will not drag or tear. This will make it unnecessary to use as much lubrication as is usually required with the aluminum alloys.

One recommended procedure[6] may be described for polishing magnesium-base alloys, such as die-castings, sheet metal products, extrusions, or sand castings. Rough polishing may be performed on canvas, sheepskin, or felt wheels, operating at 5000 to 7000 sfm, a No. 60 to 100 silicon carbide grit being recommended. A grease-stick lubricant may be used. Where slight imperfections are present, the above procedure is modified in that a built-up cloth wheel operating at 4000 to 7000 sfm may be used. A 100 to 200 silicon carbide grit, or an aluminum oxide-silicon carbide grit mixture has proven effective. A grease-stick may also be used in this type operation.

Buffing operations are usually performed on a high-count, loosely-sewed wheel, utilizing a greaseless-base tripoli compound and operating at about 7000 sfm. In the event that coloring operations are required, a Canton flannel buff, operating between 8000 and 12000 sfm, is recommended. A greaseless abrasive of dry lime is normally employed. These finer finishes require a minimum of work-to-wheel pressure to produce a satisfactory luster.

The extent of mechanical work will depend upon the surface condition of the magnesium part. The procedures employed in the removal of grease and buffing compounds are similar to those employed for mild steels, with a few reservations. In the event that alkaline cleaners are used, it is essential to avoid anodic cleaning, due to an undesirable film formation on the magnesium surface. A recommended immersion bath would consist of 3 oz./gal. of sodium carbonate and 2 oz./gal. of sodium hydroxide. The bath is operated at 190 to 212°F. and the cleaning time will range from 3 to 10 minutes. Cathodic cleaning in this bath type is permissible, a current density of 10 to 40 amp./ft.^{2} at 6 volts being recommended.[2] Parts should be cleaned until no water break occurs in the rinse. The pH of this solution should be above 11.

When the surface condition is such that polishing and buffing operations are not required, the operational procedures will involve a combination of cleaning and pickling, the specific cycle depending upon the extent and type of soil that should be removed, and

TABLE 4

***Typical Procedures for Polishing Magnesium Base Alloys*[2]**

Operation	*Abrasive*	*Type Wheel*	*Wheel Diameter, Inches*	*Wheel Speed, fpm*	*Remarks*
Rough polishing	60 to 100	Canvas, felt, or sheepskin	6 to 12	3000 to 5000	Required usually for rough surfaces, such as die castings. Greasestick may be used.
Medium polishing	100 to 200	Built-up cloth	4 to 12	4000 to 6000	For removal of minor surface defects. Greasestick may be used.
Dry fine polishing	dry compound	Loosely sewed cloth	6 to 12	3500 to 5000	
Buffing	Tripoli	Loosely sewed buff, 74 to 82 cloth count	10 to 14	6000 to 8000	
Coloring	Dry Lime	Canton flannel	12 to 16	8000 to 12000	Medium pressure to produce best luster.

type of material involved, i.e., whether it is a casting or a wrought shape.

The above-mentioned sodium carbonate-sodium hydroxide bath is used frequently. However, where an adherent graphite lubricant has been employed for hot-forming sheet metal parts, a soak cleaner consisting of 13 oz./gal. sodium hydroxide is used. The operating temperature of this bath is at 190 to 212°F., and the immersion time is 10 to 20 minutes. For the removal of heavy films of mineral oil, 0.1 oz./gal. of either a wetting agent or a soap is recommended as an addition agent. The pH of this bath should be above 13.

DeLong[4] has recommended a number of pickling solutions as a second step in surface conditioning magnesium, which included: (a) a 15 second to 3 minute immersion at room temperature in an aqueous solution consisting of 280 g./l. chromium trioxide, 25.0 ml./l. 70% nitric acid, and 8 ml./l. 60% hydrofluoric acid, for the conditioning of castings; (b) a 30 second to 1 minute immersion at room temperature in an undiluted phosphoric acid (85%) solution, also applicable for castings; (c) a 30 second to 2 minute immersion at room temperature in a solution containing 180 g./l. chromium trioxide, 30 g./l. sodium nitrate, and 2.5 g./l. calcium fluoride, for the conditioning of wrought products, and (d) a 30 second to 2 minute immersion at room temperature in a solution containing 28 ml./l. glacial acetic acid and 80 g./l. sodium nitrate, also for wrought products.

The importance of surface conditioning cannot be overemphasized, since it contributes materially to the successful bonding of the immersion zinc coating. Thus, a magnesium surface will have a variety of contaminants in the form of oxides, graphitic and metallic inclusions, porosity, and local variations of composition that must be removed completely to prevent any undesirable galvanic action upon immersion in the zinc bath to avoid affecting proper adhesion. The importance in avoiding galvanic interference has been stressed by Levy[1] in that tap water, which may be hard or contain appreciable amounts of heavy metals, should be replaced with deionized water. Stress has also been placed on thorough rinsing to prevent the formation of thin, insoluble films on the magnesium surface which would result in poor adhesion.

Activation and Zinc Deposition

The surface activation treatment may be considered an added precaution to remove any traces of surface contamination and, thus, assure a uniform zinc deposit. In the Dow procedure, a patented aqueous solution[7] containing 200 ml./l. of 85% phosphoric acid and 100 g./l. of either sodium, potassium, or ammonium bifluoride is employed. This solution removes average surface contamination without a roughening etch, as well as activating the surface.

In order to obtain an adherent metal coating on magnesium by immersion, DeLong[4] has emphasized the necessity of removing the magnesium hydroxide film and deposition of the metal at a slow and controlled rate. In earlier work, it had been found that acid solutions deposit the metal too rapidly, while most alkaline solutions above a pH 10.6 do not dissolve the objectionable magnesium hydroxide film.

Further investigations revealed that the alkaline pyrophosphates, particularly below a pH 11, react readily with magnesium hydroxide to form water

soluble compounds and the rate of zinc deposition could be controlled with an inhibitor, a small amount of fluoride being particularly effective. The bath normally used consists of an aqueous solution of 30 g./l. zinc sulfate monohydrate, 120 g./l. tetrasodium pyrophosphate, 7 to 5 g./l. sodium or potassium fluoride, and 5 g./l. sodium carbonate. Immersion time is 3 to 10 minutes, depending upon such factors as operating temperature, alloy type, freshness of bath, and the procedures used for surface conditioning. The operating temperature is between 175 to 185°F., and mild agitation of the solution is recommended.

DeLong has indicated that both the adhesion and uniformity of the zinc deposit are influenced by the zinc pyrophosphate ratio, and the carbonate concentration which is used to adjust and maintain a pH of 10.0 to 10.6. In addition, the time should be the minimum necessary to obtain complete coverage of the surface with a zinc deposit. Extended immersion periods are harmful in that the excess zinc will have little adhesion, which would ultimately result in poor adhesion on subsequent electrodeposition. It is essential that this solution be kept as free as possible from metallic impurities, contamination with chromium ions being particularly harmful.

Tap water may be used but, to assure the desired purity of the zinc bath, the use of deionized water is preferred. The major source of contamination would be heavy metal salts from other plating operations. This is particularly true with chromium, since even small amounts will inhibit the reduction of zinc.

The more critical component within the formulation is the fluoride concentration. This addition not only controls the reaction rate, but also, permits a much greater flexibility in both the concentration of other bath components and the immersion time. The value given of 0.5% sodium fluoride, or 0.7% potassium fluoride concentration, is maximum for baths processing the conventional magnesium alloys. This concentration should be halved when processing unalloyed magnesium. A slow deposition rate and a thin zinc deposit frequently are indicative that the fluoride concentration within the bath is above the maximum limit. These thinner coatings will result in a poorer adhesion of subsequent electrodeposits. The normal thickness of the zinc deposit is about 0.0001 inch.

In the event that racking is employed, Levy[1] has suggested the use of plastisol as a coating, covering the entire rack with the exception of the contact points. An alternate recommendation is that the contact tips be made from magnesium. The problem of racking was cited to be of particular importance during the cleaning and activation treatments, since this was considered as another source of galvanic interference.

The Copper Strike

The copper strike should immediately follow the zincate operation, utilizing a conventional copper cyanide bath. The deposit thickness will vary in accordance to the type plating bath that will follow, about 0.0001" being recommended[4] for subsequent plating from an alkaline solution, whereas, 0.0003" of copper is specified for plating from an acid solution. The Rochelle plating bath, operating from 150 to 160°F., with cathode agitation of about 8 to 12 ft./min., is widely used. The recommended solution composition[2,4] is 41.3 g./l. copper cyanide, 50.8 g./l. sodium cyanide, 30.0 g./l. sodium carbonate, 45.0 g./l. Rochelle salt, 7.5 g./l. sodium hydroxide, and 5.6 g./l. free cyanide. The bath should be operated at a pH of 12.2 to 12.8 (colorimetric).

A fluoride-modified bath, operated at a temperature of 130 to 150°F. at a pH range of 12.2 to 12.8 may also be used. The bath composition that has been suggested[2] includes 3.5 oz./gal. copper cyanide, 6.1 oz./gal. potassium cyanide, 2.0 oz./gal. potassium carbonate, 1.0 oz./gal. potassium hydroxide, 4.0 oz./gal. potassium fluoride, and 1.0 oz./gal. free cyanide. Agitation of this bath has also been recommended.

Both baths are usually operated at a current density of 15 to 25 amp./ft.^{2}; however, where shapes to be plated have deeply recessed areas, it is necessary to increase the current density at the beginning of the plating cycle to the range of 30 to 40 amp./ft.^{2}. The recommended time at this high current density is one minute, after which the lower value, suggested above, is used to the completion of the cycle. It is essential that the time factor at the higher current density be observed, since prolonged exposures may cause inferior adhesion and subsequent blistering.

Where periodic reverse current is used, a cycle of 15 seconds forward and 3 seconds reverse is recommended, and the initial time is 30 to 60 seconds for the forward portion of the cycle. The reason for this is that it permits the initial layer of copper to build-up to a sufficient thickness before deplating occurs on the reverse cycle.

The Plated Coating

Once the minimum thickness of copper has been applied to the magnesium part, standard plating solutions can be employed to obtain the final coating. The coating types successfully used include nickel, chromium, brass, zinc, cadmium, rhodium, gold and silver. Levy has indicated that zinc, cadmium, brass, and silver may be deposited directly; however, an undercoat of copper is usually required to obtain optimum adhesion. DeLong[3] patented a method of producing an electroplate of nickel directly on magnesium-base alloys. This method involved defilming the part in a dilute solution of a soluble fluoride, then transferring without drying to the plating bath containing nickel bifluoride, hydrogen fluoride, and from 10 to 51 g./l. of an organic polybasic acid such as tartaric or citric. The bath is maintained at a pH of 1 to 3, and operated at a temperature of 125 to 140°F. in a current density range of 30 to 100 amp./ft.^{2}.

Levy has also revealed a number of interesting pointers that may be of value. He has stated that one method of improving bond strength is by heating the plated parts to the range of 300 to 400°F. for several hours to permit diffusion of the zinc coat into both the magnesium and copper plate. The increase in bond strength is attributed to the alloying that occurs during the diffusion.

A recently developed electroless nickel process may prove to be a tremendous stride in simplifying the

plating of the magnesium base alloys. The advantages cited[1] include: (a) reduction of the problem of galvanic interference, (b) ability to seal any porosity that may appear on cast products, (c) ability to coat assemblies made of dissimilar metal combinations, and (d) since reduction of the metallic ion is catalytic rather than electrolytic, deposition is independent of geometry and is uniform even on complex shapes. This bath is reputed to have excellent throwing power, adhesion to the basis metal is good, and the corrosion resistance of the coating is equal or better than that obtained from conventional electroplates where the deposited metal is of equal thickness.

A number of conventional baths may be discussed. Heavier copper deposits may be applied from the copper strike bath; however, both the cyanide or pyrophosphate baths are normally employed. Where a bright copper plate is desired, a standard proprietary pyrophosphate bath modified with 30 g./l. of potassium fluoride will produce a smooth and bright deposit.

In depositing nickel from any conventional bath with a preferred pH of about 4.0 or above, the copper strike should have a minimum thickness of 0.0003" to avoid any possibility of attack of the magnesium through the pores of the copper deposit. With intricate designs having deep recesses, this copper strike may be on the order of 0.0008" thick so that a minimum of 0.0003" is obtained in the less accessible areas. In addition, for plating designs having deep recesses, and for plating tubing, a special nickel plating bath has been developed, containing 60 g./l. nickel sulfate, 35 g./l. boric acid, 50 to 65 g./l. ammonium fluoride or bifluoride, and 0.5 g./l. wetting agent such as sodium lauryl sulfate. Hydrochloric acid is used to obtain the preferred pH of 5.5; the temperature range is from 115 to 125°F.; and the bath is operated at 5 to 15 amp./ft.^{2}.

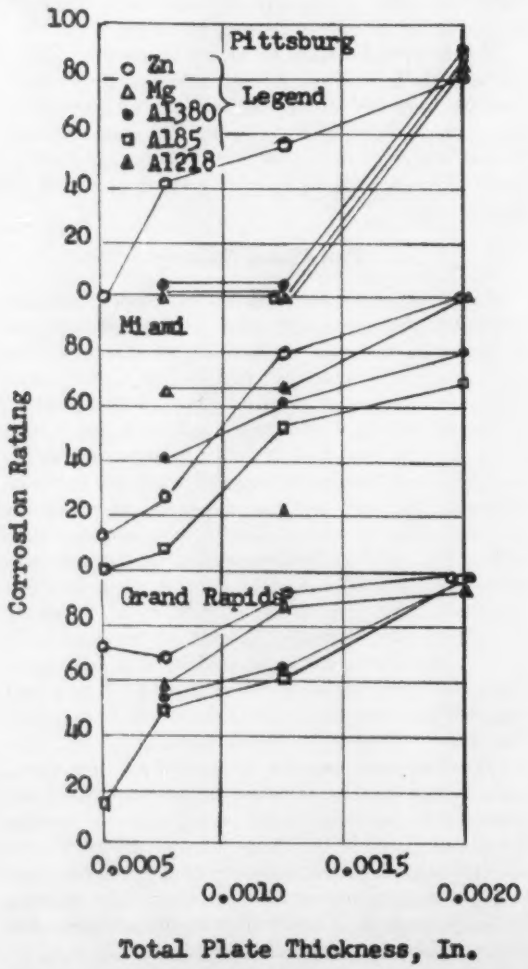


Fig. 1. Effect of exposure time on corrosion test results for Cu-Ni-Cr plates. Thickness on each panel was 0.00125 in.

Another specialty bath for plating tubing and deeply recessed parts consists of 6.5 fl. oz./gal. hydrofluoric acid, 4 oz./gal. citric acid, 16 oz./gal. basic nickel carbonate, and about 0.5 oz./gal. wetting agent. The operating conditions of this bath include a pH range of 1.0 to 3.0, obtained by additions of 85% hydrofluoric acid; a temperature range of 120 to 140°F.; a current density range of 5 to 15 amp./ft.^{2}, and cathode agitation at a speed of about 16 feet per minute. The pH of this bath is quite important since a value of 3.5 and above may result in hard and brittle deposits. In addition, the bath is reputed to be passive, with the result that there is no attack of a magnesium surface devoid of an initial copper deposit.

Decorative plate of copper-nickel-chromium may be applied with conventional procedures. Where wear resistance is of primary importance, a chromium deposit is usually applied directly after copper striking. Brass coatings are applied either directly after the zinc immersion treatment, or after the copper strike, the standard type cyanide bath being used. In silver plating from the cyanide bath, the preferred cycle would consist of deposition of a heavy copper deposit, followed by a nickel strike, and then silver deposition. In plating zinc directly on the zinc immersion coating, it is essential that electrical contact is obtained prior to immersion in the zinc plating bath. A more satisfactory deposit is obtained if the zinc or cadmium is plated on a copper strike; this being particularly true in the deposition of cadmium.

Small parts may be barrel plated, zinc being preferred since the barrel is revolved very slowly, or even intermittently, during the plating cycle. Under these conditions, marring of the plated surface is at a minimum. Generally, the amount of surface marring is much less than that experienced in barrel plating an equivalent load containing steel parts. Copper, copper-nickel, and black nickel deposits have also been obtained by barrel plating.

When nickel or copper is plated directly onto magnesium, the magnesium, since it is anodic to the electroplate, will corrode preferentially to the plated coating unless the deposit was pore-free. However, by the use of an intermediate layer of zinc, protection is obtained by minimizing this galvanic effect. The degree of protecton that is obtained, which is illustrated in

(*Continued on page* 70)

New Methods of Determination of Adhesion and Fatigue Strength of Electrodeposited Antifrictional Coatings

By Larissa Domnikov, *Process Analyst A, Norair Division, Northrop Corp.*

IN testing the quality of thin metal or alloy deposits on bearings, and also in studying their antifrictional properties, it is necessary to be able to determine exactly the adhesion between the coating and the basis metal and the fatigue strength of the coatings.

The most popular methods used for this purpose are: tearing off the deposit (by first soldering a piece of metal to the deposit, or growing a deposit with protruding edges), impact testing, bend testing, twisting, or the electrochemical method. However, adhesion cannot be determined exactly by the above methods because there are various factors influencing the bond between the coating and the basis metal, such as surface microgeometry, methods of degreasing and etching of the article, concentration of the electrolyte components, and plating conditions.

A new method of tearing off the deposits to determine the adhesion of thin electroplated antifrictional coatings to various basis metals has been developed and reported by the Russian chemists,* which, they claim, permits determination exactly all above-listed factors affecting the adhesion.

The method consists of applying thin antifrictional coatings to conical pins (Fig. 1) exactly spaced in conical cells of the base. In order to obtain an exact fit, the contact surfaces of both the pins and the cells are ground with fine pastes. Subsequently, those surfaces of the assembled base and the pins which do not receive antifrictional deposits are coated with several layers of masking lacquer. After depositing metal coatings on the functional surfaces of the base and the pins, the masking is carefully removed to avoid errors which may arise due to the tightening effect of the thick masking film in the areas of contact of the pins and the base.

The adhesion test is performed on a tensile testing machine of the type PT-250 (Russian designation) used for tensile tests of various materials, including nonmetallic, with the maximum load of 250 kg. To test the adhesion, the base with the assembled pins is fastened in a strictly horizontal position on a special steel table.

Tearing pins off the deposited coatings is effected by means of a special rod whose lower cross-cut end has a hole for gripping and holding the protruding pin ends. The rod is fastened to the tensile machine at the upper standard vise of the machine, and subsequently is tested for coaxiality in respect to the test specimens.

In testing the adhesion of iron-zinc antifrictional deposits to the various materials (copper, cast iron, brass, steel), the functional surface area of a pin was 1.02mm.^{2}. The thickness of the plate in this case was 0.5 mm. The Russian researchers observed the phenomenon of a clear tear without traces of cut.

The use of the above method allowed them to determine the effect of various factors on the adhesion. Thus, for instance, after degreasing surfaces with Vienna lime, the adhesion of the iron-zinc coating to copper was 1100 kg./cm.^{2}, to cast iron 1350 kg./cm.^{2},

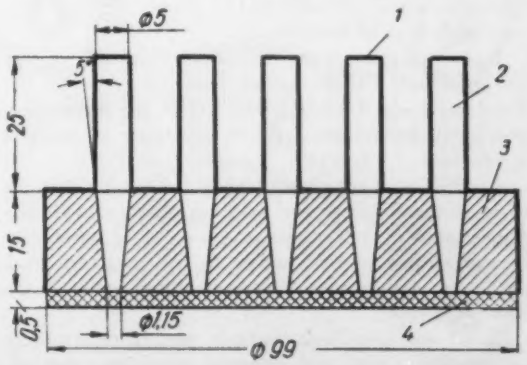


Fig. 1. Diagram of conical pins placed in conical cells of a specimen's base. 1—masking film; 2—conical pins; 3—specimen's base with conical cells; 4—electrodeposited coating.

*G. G. Gugunishvili, Zavodskaia Laboratoria (Plant Laboratory), No. 3, 333 (1958).

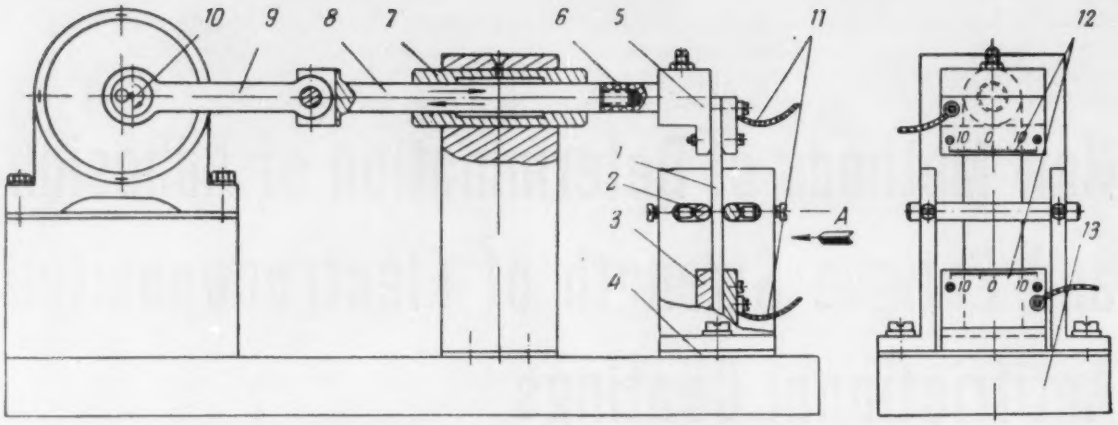


Fig. 2. Diagram of installation for testing fatigue strength of electro deposited coatings. 1—test specimen; 2—clamping rods; 3—lower vise; 4—isolating gasket; 5—upper vise; 6—ebonite tip; 7—bronze bushing; 8—rod; 9—connecting rod; 10—cam gear; 11—circuit wires; 12—dials; 13—base.

and to steel 970 kg./cm.^{2}, whereas, after electrolytic cleaning, the adhesion was 1406, 1225, 1540, and 1135 kg./cm.^{2} respectively. The adhesion of iron-zinc alloy coatings was determined with a great precision. It must be noted that, in the event the researchers observed after testing a cut in the coating on the functional surface of the specimen (which happened very seldom), they ignored the results of this test and repeated the experiment.

The testing of monometallic electrodeposits gives the exact qualitative evaluation of their stress condition and permits taking into consideration the effect of changes in the concentration of electrolyte constituents, plating conditions, thickness of the deposits, etc., on the fatigue strength.

However, no standard instruments for testing monometallic samples were available. The Russians designed and built an apparatus for measuring the fatigue strength of electrodeposited coatings, which produces the desired test conditions. One of the advantages of this apparatus is that, due to the connection of a milliammeter to the circuit, which is sensitive to the appearance even of the minutest fatigue cracks, it is possible to carry on a continuous observation of test specimens in the process of testing.

In testing, round steel rods, 3 mm. in diameter, are pressed tightly to monometallic flat specimens, 10 mm. wide and 80 mm. long. The specimens are clamped bracket-like and are subjected to double bending (the bent portion is 40 mm. long).

The magnitude of the vibration amplitude of the test specimens (in the experiments conducted by the Russians it was 2.5 mm.), the size of the installation and other factors are selected according to the test conditions.

The results of laboratory tests of the fatigue strength of monometallic iron- zinc coatings obtained with different ratios of concentrations (in g./l.) of basic salts of zinc sulfate to iron sulfate in the electrolyte and all other plating conditions remaining constant are listed in Table I.

Thus, the described methods permit determining qualitatively, with the required precision, the adhesion and the fatigue strength of various electrodeposited antifrictional coatings.

TABLE I

Plating conditions		*Coating microhardness (average of 10 readings*	*Cross-sectional area, mm.^{2} (average of 3 readings)*	*Number of cycles until specimen failure (average of 3 readings)*
	2	88	1.8	7200
	4	71	2.0	59040
Ratio of zinc	6	61	1.9	69120
sulfate to iron	8	45	1.9	18720
sulfate	10	40	1.8	17280
	12	40	1.9	23040
	0.33	65	2.0	74880
Ratio of iron	0.5	70	1.9	97920
sulfate to zinc	0.66	73	1.8	123840
sulfate	0.77	89	1.9	208800
	1	94	2.1	319680
	1.16	102	1.9	305280
	1.33	104	1.9	181440
	1.5	123	1.8	5760
	1.66	138	1.9	2880

Dynamic Method of Testing

If a part is subjected in service to cyclic stresses and shocks, the testing of specimens under static loads will not give true indication of the coating adhesion. As an example, this happens when an aluminum coating loses adhesion to the steel base of engine bushings in the process of dynamic loading. A method has been developed by the researchers** at the Russian State Research Tractor Institute, which, they claim, can more simply determine the adhesion than all other existing methods. This method consists of testing the adhesion by shearing or tearing the coating off the basis metal under a dynamic load. For this purpose, small tie plates of coating are left on the test specimen by making circular or linear cuts on it. The depth of cuts must exceed somewhat the coating thickness.

The test is conducted with a pendulum hammer

**Iu. Ia. Silberg, Zavodskaia Laboratoria (Plant Laboratory), No. 3, 335 (1958).

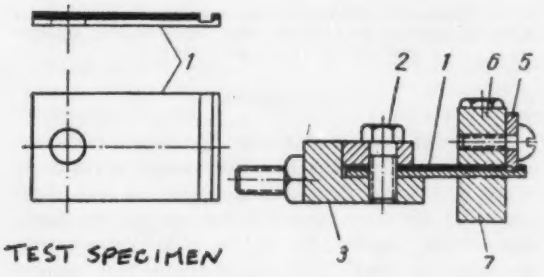
equipped with outrigger stops in special fixtures. The test installation for the dynamic shear test is shown in Figs. 3 and 4. The test specimen 1 (see Fig. 3) is fastened with the bolt 2 to the holder 3 which is screwed into the socket of the rear end of the pendulum hammer 4. The knife 5, fastened to the cross-arm 6-7, is placed into the cut (channel) on the other end of the specimen. In testing, the specimen carried by the pendulum 4 is subjected (depending on the quality of adhesion) to a partial or total shear of the coating upon the impact of the cross-arm 6-7 against the outrigger stops 8 of the hammer.

The work required in this dynamic testing of specimens indicates the qualitative evaluation of adhesion expressed in kg./cm.^{2} of sheared area of the specimen's coating.

The presence of four cuts on the standard specimen 1 (see Fig. 4a) permits quick determination of the average adhesion. It is also possible to test several areas on the specimen 2 (see Figs. 4b and 4c), by shearing simultaneously with the comb knife 3 and by shearing partially the tie plate (see Fig. 4d).

The purpose of these latter tests is to check the absence of shear of plastic plated metal alloys and also to compare the quality of adhesion on the basis of the minimum allowed value for the remaining tie plate. Fig. 5 shows an installation for the dynamic tearing-off test.

Before testing, several concentric (a) or parallel



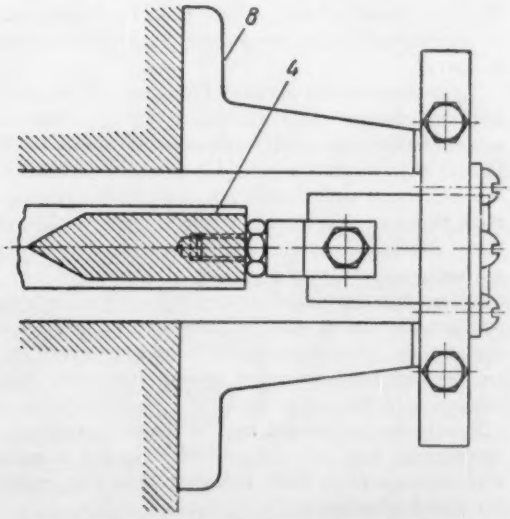


Fig. 3. Installation for dynamic shear testing of coatings.

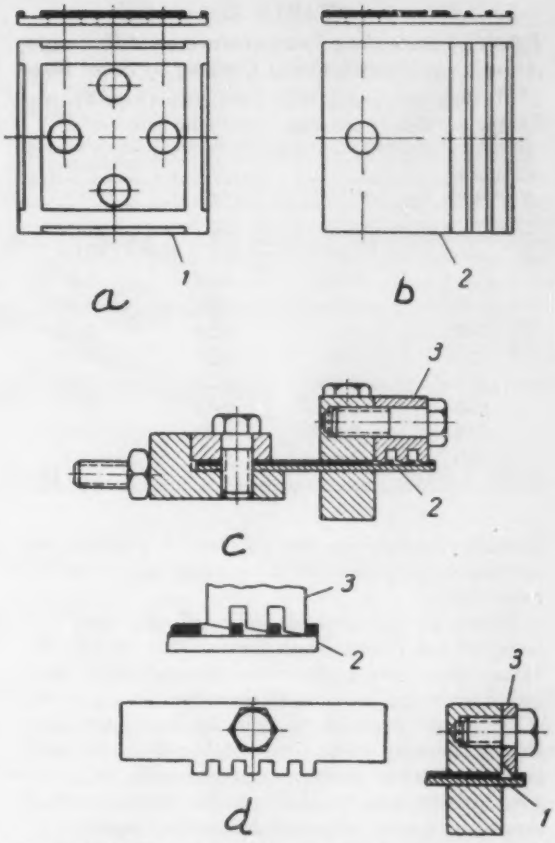


Fig. 4. Installation for simultaneous dynamic shear testing of several areas on the specimen and of the tie plate.

(b) cuts are made on both the specimen's coating and the basis metal. The coating remaining on the tie plate $\Delta 1$ is subjected to tearing-off.

The specimen 1 is fastened with the bolts 2 to the cross-arm 3 and with the bolt 4 to the stud 5. Between the bolt 4 and the test specimen, the stirrup bolt 6 (or a washer) is placed to press the specimen's coating to the stud 5. The stud is screwed into the socket of the rear end of the pendulum hammer 7.

Upon the impact of the cross-arm 3 against the outrigger stops 8, the dynamic tearing of the coating from the basis metal takes place. The work required for the dynamic testing of the specimen expresses the qualitative evaluation of adhesion in kg./cm.^{2} of the torn-off area of the coating.

The specific impact work a_k is calculated according to the following formula:

$$a_k = \frac{A}{F} = \frac{A}{\Delta 1 \cdot L} \text{ kg./cm.}^2$$

where A is the impact work in kg., F is the cross-sectional area of the test specimen in cm.^{2}, L is the length of the torn off tie plate. This characteristic is an objective indication of the quality of adhesion of metals in bimetals.

The required width of the tie plate (the coating strip $\Delta 1$), which is tested for adhesion, for both the specimens tested by the dynamic shearing (Fig. 3) and the specimens tested by the dynamic tearing,

TABLE II

Effect of Annealing Temperature on Adhesion of Aluminum Antifrictional Coating of Steel Basis

(Testing specimens with four cuts (Fig. 4) with Sharpi pendulum hammer, pendulum rise 60°.)

Annealing temperature, °C.	*Specimen's area cm.²*	*Impact work, A kg.*	*Specific impact work, a kg./cm.²*
	0.56	0.52	0.93
460	0.60	0.53	0.89
	0.64	0.58	0.91
	0.68	0.61	0.90
500	0.64	0.59	0.92
550	0.64	0.57	0.89
575	0.64	0.58	0.91
600	0.64	0.48	0.75
625	0.64	0.20	0.31
650	0.64	—	—

basically depends on the number of physical and mechanical properties of the coating and is selected empirically.

Testing by both methods indicated very small scattering of test results. Thus, the variation in adhesion values after testing the same specimen four times (see Fig. 4) by the dynamic shear test did not exceed 5-7% of the required work in kg./cm.² (see Table II).*** Lengthy service tests of Diesel engine bushings, which were made from a bimetallic strip of a good quality and checked by the above methods, showed no loss of adhesion of aluminum coating.

The described methods have been adapted by a number of Russian tractor manufacturing plants and the metallurgical plant "Krasny Oktiabr" for testing the adhesion of aluminum coatings to the steel basis.

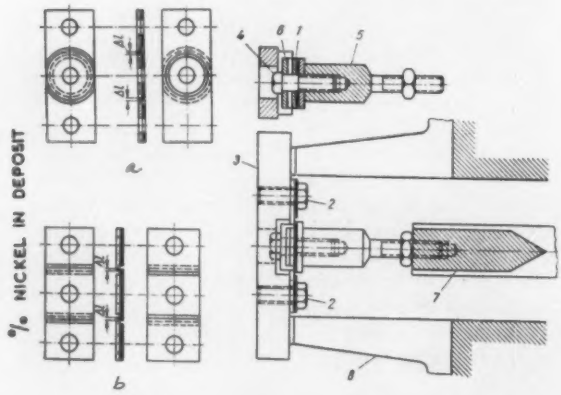


Fig. 5. Installation for dynamic tear-off testing of coatings.

Note: At 600°C., adhesion decreased 17% due to the diffusion of aluminum into iron, at 625°C. it decreased 66%, and at 650°C. a complete delamination of the aluminum layer took place.

***As pointed out by N. N. Davidenkov ("Dynamic testing of metals," ONTINKPS, 1936), to obtain the required precision of test results it is necessary to work with a hammer whose pendulum's power insignificantly exceeds the amount of work required for the specimen testing.

FINISHING PROCEDURES FOR MAGNESIUM

(*Continued from page 66*)

Figures 1 and 2, compares favorably to that realized in the decorative plating of both aluminum and zinc base die castings.

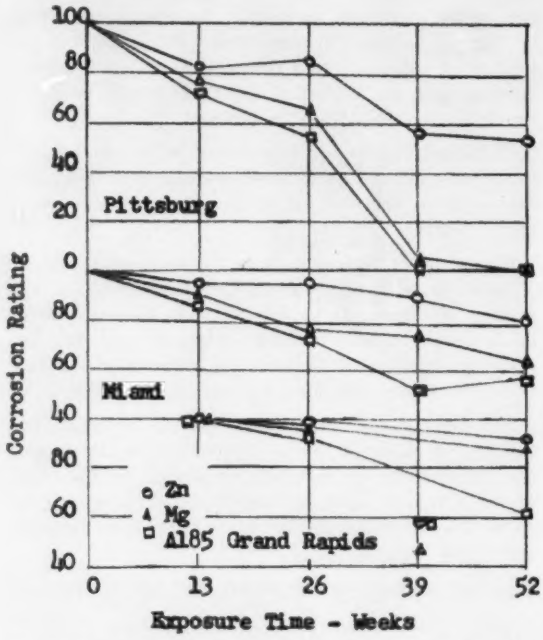


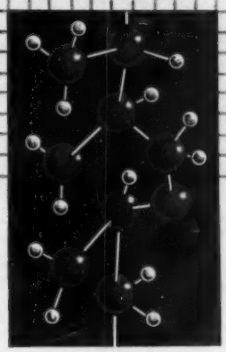
Fig. 2. Comparative results of exposure tests in Cu-Ni-Cr plates of varying thickness on aluminum, magnesium and zinc. Exposure time was one year at each test site.

Conclusion

The use of plated coatings on magnesium and magnesium base alloys has been increasing, particularly in the deposition of nickel, duplex nickel, and chromium. Of the three, nickel deposition has the fewer applications, whereas, the duplex nickel deposit with chromium is used[9,10] for applications that require wear resistance, particularly on printing plates and hydraulic brake systems. There is an increasing usage of magnesium plated component parts in the aircraft industry.

To summarize the plating of magnesium, it may be well to compare this procedure to a comparable process in the coating of the aluminum-base alloys. The factors that would be considered would include (a) the equipment and installation costs in the plating of these two materials would be roughly comparable, (b) more stringent solution and process control are required compared to the plating of aluminum, (c) in the event that the plated coating will serve a decorative purpose the plating costs of these two procedures are comparable, (d) where the intended service will be at an elevated temperature, a baking operation, which consists of a heating to 300-400°F. for several hours, will introduce an added cost in the electroplating of magnesium, and (e) the cost of stripping a deposit with subsequent re-work is higher than that realized for plated aluminum.

(*All References will appear with Part III*)



SYNTHETIC RESINS

The Backbone of Modern Finishes

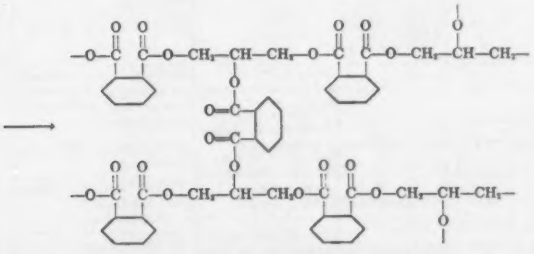
A SURVEY OF THE LATEST DEVELOPMENTS IN SYNTHETIC RESINS USED IN COATINGS

Part XI - Alkyds (Section A)

By Harold P. Preuss

THE word "alkyd" was coined over thirty years ago to indicate a type resin made from alcohols and acids. The classic definition of an "alkyd" is "the resinous product of polyhydric alcohols and polybasic acids." Actually many modifications are possible; thus "alkyd" resins include a wide variety of resinous products, all of which, in a broad sense, may be considered as Polyester Resins, as defined in the first (June, 1960) article of this series.

The simplest form of an alkyd resin may be prepared by the interaction of glycerol and phthalic anhydride at a temperature of 160°F. or higher. A hypothetical portion of the crosslinked alkyd resin is illustrated by the formula:



Although glycerol and phthalic anhydride are the most common fundamental components of commercial alkyds, many others are used. Maleic anhydride is the second most valuable dibasic acid intermediate used, though it is usually employed as its rosin adduct. Other dibasic acids used are fumaric, succinic, adipic, azelaic, sebacic, and isophthalic. A number of substitutions for glycerol may also be used, either alone or in combination with glycerol. Examples are pentaerythritol, trimethylol ethane, propane, sorbitol, and mannitol.

Unmodified glyceryl phthalate resins have not been used very widely because of their poor solubility characteristics. However, in their *modified* forms, alkyd resins are extensively used. Such modifying agents generally consist of drying, semi-drying, or non-drying oils and both natural and synthetic resins.

Oil-modified alkyd resins may be described in terms of oil length as short, medium, and long. The composition ranges of these classes are generally considered as follows:

Type Resin	*Phthalic Anhydride Content*	*Oil Acid Content*
Short	40 - 50%	30 - 40%
Medium	30 - 40%	40 - 50%
Long	20 - 30%	over 50%

The oil-modified alkyds dry both by condensation and auto-oxidation and they are thus suitable for use in both baking and air-drying finishes.

Synthetic resins with which alkyds are frequently modified or blended are the phenolics, ureas, melamines, rosin esters, natural resins, etc. Styrenated alkyds form one of the largest groups of alkyd-resin copolymers; these were described in the preceding article of this series.

Alkyd resins may likewise be modified with such natural resins as congo ester or ester gum.

Generally speaking, alkyd resins are noted for their durability under a wide range of exposure conditions. They are affected only slightly by greases, moderate temperature conditions, and outdoor weather. Baking types retain gloss and color.

Alkyd-type resins are used in such varied applications as enamels, lacquers, textile finishes, metal primers, caulking compounds, leather coatings, and water emulsion paints. Automobile, railway, and metal household appliance primers and finishes also represent an important use for these resins.

Manufacturers of Alkyd Resins

In this article series we will outline the properties

PROPERTIES OF ALKYD RESINS
(For Metal Finishing)

CHART 1

MANUFACTURER	RESIN	% SOLIDS	SOLVENT	COLOR GARDNER 1933	ACID NO.	VISCOSITY GARDNER-HOLDT	POUNDS PER GALLON	% PHTHALIC ANHYDRIDE	% OIL	TYPE OF OIL	PROPERTIES	APPLICATIONS
ALLIED CHEMICAL	PLASKON 3101	60	XYLOL + 2% BUTANOL	1-4	2-6	Z_1-Z_3	8.6-8.7	43	32	COCONUT	RETAINS COLOR AND GLOSS. ALKALI RESISTANT	WHITE INDUSTRIAL APPLIANCE FINISHES
	PLASKON 3103	60	XYLOL	1-3	3-6	Z_5-Z_7	8.55-8.65	44	32	HYDROGENATED COCONUT	RETAINS COLOR SOAP AND GREASE RESISTANT	BAKED APPLIANCE FINISHES
	PLASKON 3103-2	60	"SOLVESSO 150" + 5% BUTANOL	1-3	3-6	Z_5-Z_7	8.6-8.7	44	32	HYDROGENATED COCONUT	SIMILAR TO 3103 SLOW EVAP. SOLVENT	ROLLER COAT APPLICATIONS
	PLASKON 3105	60	XYLOL	1-3	1-4	Z_3-Z_5	8.55-8.65	43	34	COCONUT	ULTIMATE IN COLOR RETENTION	WHITE BAKING ENAMELS FOR APPLIANCES, ETC.
	PLASKON 3105-2	60	TOLUOL	1-3	1-4	Y-Z_2	8.5-8.6	43	34	COCONUT	SIMILAR TO 3105 BUT FASTER EVAP.	SIMILAR TO 3105
	PLASKON 3115	60	XYLOL	1-4	3-6	X-Z	8.4-8.5	38	48	CASTOR	SUPERIOR ADHESION AND FLEXIBILITY	LACQUERS AND BAKING ENAMELS FOR APPLIANCES
	PLASKON 3120	50	XYLOL + BUTANOL (5%)	3-6	2-5	Z-Z_2	8.25-8.35	39	37	DEHYDRATED CASTOR	EXCELLENT COLOR, GLOSS, RAPID CURE, ETC	GENERAL PURPOSE BAKING FINISH
	PLASKON 3120-2	50	XYLOL + 5% BUTANOL	3-6	4-7	V-W	8.25-8.35	39	37	DEHYDRATED CASTOR	SIMILAR TO 3120 BUT LOWER VISCOSITY	SIMILAR TO 3120
	PLASKON 3121	50	"SOLVESSO 150" + BUTANOL	3-6	2-5	Z-Z_2	8.3-8.4	39	37	DEHYDRATED CASTOR	OUTSTANDING COLOR RETENTION, GLOSS, TOUGHNESS WEATHER RESIS.	ROLLER COATING, VENETIAN BLINDS, SIGNS, CAN COATINGS
	PLASKON 3121-2	50	"SOLVESSO 150" + BUTANOL	3-6	4-6	W-Y	8.3-8.4	39	37	DEHYDRATED CASTOR	GOOD COLOR RETENTION, ADHESION AND FLEXIBILITY	HIGH SPEED ROLLER COATING MACHINES
	PLASKON 6114	60	"SOLVESSO 100"	4-7	3-6	X-Y	8.4-8.5	39	42	CASTOR-DEHYDRATED CASTOR	SIMILAR TO ABOVE	ROLLER COAT METAL DECORATING APPLICATIONS
	PLASKON 6118	65	XYLOL	4-7	2-5	X-Z	8.6-8.7	39	42	CASTOR-DEHYDRATED CASTOR	SIMILAR TO ABOVE	SIMILAR TO 6114 BUT HIGHER IN SOLIDS
	PLASKON 3125	50	XYLOL + 5% BUTANOL	3-7	2-5	Y-Z_2	8.2-8.3	42	36	COTTONSEED	RESISTS SOAP AND WEATHER; RETAINS GLOSS	FAST CURING INDUSTRIAL BAKING ENAMELS
	PLASKON 3127	50	75% XYLOL 25% V.M. & P. NAPHTHA	3-6	2-5	Z_5-Z_7	8.1-8.3	42	36	COTTONSEED	RAPID CURING; GOOD DURABILITY, APPEAR. & GLOSS	ONE-COAT HIGH-GLOSS BAKING ENAMELS
	PLASKON 3127-2	45	80% XYLOL 20% V.M. & P. NAPHTHA	3-6	2-5	Z-Z_2	8.0-8.1	42	36	COTTONSEED	SIMILAR TO 3127 BUT LOWER VISCOSITY	SIMILAR TO 3127 BUT EASIER HANDLING
	PLASKON 6125	50	XYLOL	3-7	2-5	Z_2-Z_5	8.2-8.3	42	36	COTTONSEED	SIMILAR TO 3125 HAS HIGHER REDUCED VISCOSITY	SIMILAR TO 3125
	PLASKON 6126	55	XYLOL + 2% BUTANOL	3-7	3-6	Z_4-Z_6	8.35-8.4	42	36	COTTONSEED	SIMILAR TO 3125 BUT HIGHER IN SOLIDS	SIMILAR TO 3125
	PLASKON 3128	50	75% XYLOL 25% V.M. & P. NAPHTHA	4-7	1.5-5	Z_5-Z_7	8.1-8.2	42	36	SELECTED OXIDIZING FATTY ACIDS		GENERAL PURPOSE INDUSTRIAL BAKING FINISHES
	PLASKON 3129	50	85% XYLOL 15% V.M. & P. NAPHTHA	2-5	3-6	Z_3-Z_5	8.1-8.2	42	36	SELECTED OXIDIZING FATTY ACIDS		SIMILAR TO 3128
	PLASKON 3149	50	75% XYLOL 25% MIN. SPIRITS	7-10	2-5	Z-Z_2	8.0-8.1	38	41	LINSEED	EXCELLENT METAL ADHESION, FLEXIBILITY, TOUGHNESS	AUTOMOTIVE PRIMERS, HARDWARE AND METAL FURNITURE BAKING ENAMELS
	PLASKON 3160	50	XYLOL	4-8	2-5	V-Y	8.2-8.3	39	42	SOYBEAN	SUPERIOR SOAP RESISTANCE. GOOD COLOR, GLOSS, DURABILITY	INDUSTRIAL BAKING FINISHES
	PLASKON 3161-3	50	XYLOL	4-8	10-15	S-U	8.15-8.25	40	44	SOYBEAN	EXTREMELY RAPID CURE	AUTOMOTIVE, TRUCK AND SIMILAR FINISHES
	PLASKON 3162	50	XYLOL	3-6	3-7	T-V	8.1-8.3	41	41	SOYBEAN	GOOD COLOR & GLOSS RETENTION EASE OF SPRAYABILITY	INDUSTRIAL BAKING ENAMELS
	PLASKON 3162-3	50	50% XYLOL 50% V.M. & P. NAPHTHA	3-6	3-7	Z_2-Z_4	7.8-8.0	41	41	SOYBEAN	SIMILAR TO 3162 BUT HIGHER VISCOSITY	SIMILAR TO 3162
	PLASKON 3162-4	25	MIN. SPIRITS	2-4	15-35	U-X	7.0-7.1	41	41	SOYBEAN	LOW SOLIDS UNUSUAL HOLDOUT	PRIMER-SEALER APPLICATIONS
	PLASKON 3191	50	50% XYLOL 50% MIN. SPIRITS	9-12	11-15	Y-Z_3	7.9-8.0	41	43	SOYBEAN-CHINAWOOD	OUTSTANDING GLOSS, ADHESION, WEATHERING	AUTOMOTIVE AND GENERAL PURPOSE. NOT FOR WHITE ENAM.
	PLASKON 3040-4	50	MIN. SPIRITS	DARK	2-5	W-Y	7.5-7.6	31	55	LINSEED	GOOD GLOSS, DURABILITY, RAPID DRY	DARK-COLORED SOLUTION FOR RAILROAD PAINTERS
	PLASKON 3042	50	MIN. SPIRITS	DARK	2-5	Z-Z_2	7.5-7.6	31	55	LINSEED	SIMILAR TO 3040-4 BUT HIGHER VISCOSITY	SIMILAR TO 3040-4
	PLASKON 3148	50	MIN. SPIRITS	7-10	2-5	Y-Z_1	7.5-7.6	30	56	LINSEED	FAST-DRYING; GOOD EXTERIOR DURABILITY	AIR DRYING OR BAKING FINISHES FOR WOOD OR METAL

PROPERTIES OF ALKYD RESINS
(For Metal Finishing)

CHART 2

MANUFACTURER	RESIN	% SOLIDS	SOLVENT	COLOR GARDNER 1933	ACID NO.	VISCOSITY GARDNER-HOLDT	POUNDS PER GALLON	% PHTHALIC ANHYDRIDE	% OIL	TYPE OF OIL	PROPERTIES	APPLICATIONS
ALLIED CHEMICAL	PLASKON 6141	50	MIN. SPIRITS	4-7	4-7	V-X	7.45-7.55	28	58	SOYBEAN LINSEED	FAST DRYING	INDUSTRIAL, MAINTENANCE AND MARINE ENAMELS
	PLASKON 6143	50	MIN. SPIRITS	4-7	3-5	T-V	7.5-7.6	33	52	LINSEED	GOOD WETTING	GRINDING VEHICLE USED WHERE ENAMEL REQUIRING FED. SPEC. TT-R-266a, TYPE II, CLASS A
	PLASKON 3150	50	XYLOL	8-12	3-7	U-W	8.0-8.2	30	46	SOYBEAN	FAST DRYING	FARM MACHINERY AND IMPLEMENT FINISHES
	PLASKON 3170	60	MIN. SPIRITS	3-6	1-4	Z_1-Z_2	7.7-7.8	26	57	SOYBEAN	VERY LIGHT COLORED	AIR DRYING FINISHES
	PLASKON 3170-2	65	XYLOL	3-6	1-5	X-Y	8.1-8.2	26	57	SOYBEAN	SIMILAR TO 3170	INDUSTRIAL SPRAY OR DIP APPLICATIONS
	PLASKON 3171	50	ODORLESS MIN. SPIRITS	3-5	2.5-5	U-W	7.3-7.4	20	66	SOYBEAN	HIGH GLOSS	INTERIOR OR EXTERIOR FINISHES
	PLASKON 3175-2	60	MINERAL SPIRITS	6-10	3-6	R-U	7.35-7.6	23	63	SOYBEAN		IMPLEMENT FINISHES; FREIGHT CAR PAINT
	PLASKON 3175-3	70	MINERAL SPIRITS	3-6	3-7	Y-Z_1	7.8-8.0	23	63	SOYBEAN	GOOD GLOSS, TOUGHNESS, AND DURABILITY	MARINE PAINTS
	PLASKON 3177	70	MIN. SPIRITS	4-7	3-7	Z-Z_2	7.8-8.0	23	65	SOYBEAN	EASY BRUSHING; RAPID DRYING; GLOSS AND COLOR RETENTIVE	MARINE AND RAILWAY FINISHES
	PLASKON 3177-2	60	MIN. SPIRITS	3-7	2-4	U-V	7.6-7.8	23	65	SOYBEAN	SIMILAR TO 3177 - BUT LOWER SOLIDS	SIMILAR TO 3177
	PLASKON 3254	50	XYLOL	10-13	6-10	X-Z	8.2-8.4	34	22	LINSEED-CASTOR	OUTSTANDING OIL RESISTANCE	TOY AND STENCIL ENAMELS; DRUM PAINTS; PRIMERS
	PLASKON 3256	50	XYLOL	9-13	10-15	Y-Z_2	8.2-8.4	43	30	LINSEED	GASOLINE RESISTANT	AUTOMOTIVE CHASSIS BLACKS
AMERICAN CYANAMID	REZYL 92-5	60	XYLOL	2-5	4-10	Z_2-Z_5	8.6	45	D 30	NON-DRYING TYPE	COLOR RETENTION; HEAT RESISTANT	LAMP HOUSINGS; STOVE TRIMMINGS; PALE LACQUERS
	REZYL 94-5	60	XYLOL	2-4	6-10	Z_2-Z_5	8.6	43	D 30	NON-DRYING TYPE	RESISTS DETERGENTS, WEAK ACIDS & ALKALIS	EXTERIOR METAL LACQUERS
	REZYL 99-5	60	XYLOL	3-6	4-8	Z_2-Z_5	8.6	43	D 34	NON-DRYING TYPE	HIGH GLOSS; GOOD COLOR RETENTION	BAKING FINISHES; HIGH QUALITY NITROCELLULOSE LACQUERS
	REZYL 310-5	50	XYLOL	4-8	4-10	Z_2-Z_5		41	D 34	SOYA	TOUGHNESS; ADHESION	BAKING FINISHES IN COMBINATION WITH AMINO RESINS
	REZYL 330-5	50	XYLOL	5-9	4-10	X-Z_1	8.2	39	D 40	DEHYDRATED CASTOR	TOUGHNESS; GOOD ADHESION IN BAKED FINISHES	WHEN USED WITH MELAMINE RESIN USEFUL IN WASHING MACHINE ENAMELS
	REZYL 387-5	55	XYLOL	3-6	6-12	Z_2-Z_5	8.4	41	D 33	SOYA	PALE COLOR; GOOD COLOR RETENTION	EXTERIOR FINISHES ON METAL SURFACES
	REZYL 412-1	50	MIN. SPIRITS	4-8	3-8	U-W	7.8	30	D 50	SOYA	ADHESION; TOUGHNESS; DRIES FAST	ROLLER COATING FINISHES; GOOD EXTERIOR DURABILITY ON METAL
	REZYL 435-1	50	MIN. SPIRITS	5-9	6-12	Z_2-Z_5	7.7	34	D 48	SOYA	RESISTANT TO WATER SPOTTING GASOLINE AND OILS	PUMP AND AUTOMOTIVE ENAMELS
	REZYL 750-17	50	V.M. & P. NAPHTHA	9	15	Z-Z_2	7.2	23	D 38	REFINED TALL OIL	GOOD KNIFE-SCRATCH; NON-WRINKLING	FAST AIR-DRYING AND BAKING FINISHES
	REZYL 811-1	50	MIN. SPIRITS	5-9	4-10	Z-Z_3	7.8	35	D 46	LINSEED	FAST SET; RAPID AND COMPLETE THROUGH DRY	AUTOMOTIVE AND MACHINERY FINISHES
	REZYL 869-1	70	MIN. SPIRITS	7-10	4-8	W-Y	8.1	27	D 56	LINSEED	FAST-DRYING	STEEL PRIMERS AND ALUMINUM PAINTS
	REZYL 1102-5	40	XYLOL	5-9	40-60	Y-Z_3	8.1	50	D 28	LINSEED	BLENDS WELL WITH UREA-FORMALDEHYDE RESINS	METAL OBJECTS WHERE EXTREME FLEXIBILITY IS NOT REQUIRED
	REZYL 7366-51	50	XYLOL AND MIN. SPIRITS	4-8	6-10	M-O (2)					BLOW VISCOSITY DECREASES WHEN THINNED WITH AROMATIC SOLVENTS	LOW-COST BAKING ENAMEL

(1) MIN. OIL ACIDS

(2) REDUCED TO 40% SOLIDS WITH XYLOL

PROPERTIES OF ALKYD RESINS
(For Metal Finishing)

CHART 3

MANUFACTURER	RESIN	% SOLIDS	SOLVENT	COLOR GARDNER 1933	ACID NO.	VISCOSITY GARDNER-HOLDT	POUNDS PER GALLON	MAX % PHTHALIC ANHYDRIDE	% OIL	TYPE OF OIL	PROPERTIES	APPLICATIONS
JONES-DABNEY	SYNTEX H-3	100	NONE	11	30-40	—	9.43	NONE	0	—	GOOD SOLVENT SOLUBILITY, FAST SOLVENT RELEASE	HARD, FAST-DRYING LACQUERS
	SYNTEX 9	50	XYLOL	8	9-13	Z_1-Z_3	9.68	39.5	40	DEHYDRATED CASTOR	HARD, ELASTIC, TOUGH	GASOLINE PUMPS; WASHING MACHINES; MEDICINE CABINETS
	SYNTEX H-12	50	35% HVA 10% XYLOL 55% VMP	12	12-25	V-X	9.09	22.0	40	CHINA-WOOD LINSEED	FAST DRY; DOES NOT WATER SPOT	AUTO REFINISH ENAMELS
	SYNTEX 23	50	MINERAL SPIRITS	7	4-6	U-W	9.10	34.0	52	LINSEED	FAST DRY	OIL TRUCKS; FIRE HYDRANTS; SIGNS
	SYNTEX 23-SD	50	MINERAL SPIRITS	DARK	4-7	Z_1-Z_3	9.10	31.5	52	LINSEED	LOWER COST THAN 23	SAME AS 23 WHERE COLOR IS NOT A FACTOR
	SYNTEX 56	70	MINERAL SPIRITS	7	4-6	Z_2-Z_4	8.87	26.0	62	SOYA	EXCELLENT FLOW, COLOR, DRYING RATE	HIGH QUALITY WHITE ENAMELS
	SYNTEX 62	50	MINERAL SPIRITS	7	4-7	T-V	8.96	30.8	56	SOYA	GOOD BAKING AND EXTERIOR DURABILITY	ROLLER COATING CLEARS FOR CANS AND SIGNS
	SYNTEX 62-V	50	50% MIN. SPIRITS 50% VMP	7	4-7	T-V	8.96	30.8	56	SOYA	FAST DRY; EXCELLENT EXTERIOR DURABILITY	AUTO REFINISH; SPRAY FARM MACHINERY ENAMELS
	SYNTEX 66	50	HIGH FLASH NAPHTHA	7	18-24	Z_4-Z_6	9.95	PRESENT	-	-	EXCELLENT SURFACE HARDNESS AND MAR PROOFNESS	METAL AWNINGS
	SYNTEX 75	55	XYLOL	6	6-12	Z_4-Z_6	9.71	41.6	40	SOYA	GOOD GLOSS; FAST, HARD, CURE	BAKING PRIMER
	SYNTEX 77	50	MINERAL SPIRITS	7	4-7	T-V	8.92	30.8	56	SOYA	CHEAPER THAN 62 BUT EQUAL IN GLOSS & COLOR	GENERAL MAINTENANCE FINISHES
	SYNTEX 115	45	4% XYLOL 8% MIN. SPIRITS 88% VMP	11	15-25	Z_1-Z_3	9.48	34.0	38	SOYA	HIGH GLOSS; GOOD COLOR	TOY ENAMELS; AUTOMOTIVE WHEEL ENAMELS
	SYNTEX 121	50	40% XYLOL 60% L.D. NAPHTHA	9	52-57	Z_1-Z_5	9.88	PRESENT	38	DEHYDRATED CASTOR	LIGHT SHADES BUT NOT WHITE EXCELLENT WETTING	WRINKLE ENAMELS
	SYNTEX 128	60	MINERAL SPIRITS	13	16-19	F-H	8.79	PRESENT	42	SOYA	PERMITS HIGH PIGMENT CONCENTRATION	GENERAL PURPOSE GRINDING ALKYD
	SYNTEX 130	50	XYLOL	11	28-38	W-Y	9.30	PRESENT	30	CHINA WOOD	GOOD MAR RESISTANCE; PHENOLIC MODIFIED	EXTREMELY FAST DRY INDUSTRIAL ENAMELS
	SYNTEX 133	50	MINERAL SPIRITS	DARK	10-20	Y-Z_1	8.70	PRESENT	50	LINSEED	EXCELLENT DURABILITY, HARDNESS, MAR PROOFNESS	SPRAY TYPE INDUSTRIAL FINISHES
	SYNTEX 143	60	60% VMP 8% L.D. NAPHTHA	11	20-30	Z_5-Z_6+	9.38	PRESENT	-	SOYA	LOW COST; RAPID DRY	INDUSTRIAL FINISHES
	SYNTEX 3034-B	50	MINERAL SPIRITS	6	4-9	Z_5-Z_6+	9.44	35.0	48.5	SOYA	NON-YELLOWING	HIGH VISCOSITY GENERAL PURPOSE ALKYD-ENAMELS

CODE: HVA = Heavy Aromatic Naphtha
VMP = Varnish Makers' & Painters' Naphtha

and applications of alkyd resins made by U.S.A. manufacturers for use in formulating coatings employed in metal finishing operations. However, the list of these resins is so long that we have been forced to depart from the practice employed in former articles — namely to devote several paragraphs to a description of each resin. Instead we have assembled the data in tabular form.

The alkyd resins described in the accompanying three charts are made by the following firms:

Allied Chemical Corporation, Plastics Division, New York 6, N. Y.

American Cyanamid Company, Plastics and Resins Division, New York 20, N. Y.

Jones-Dabney Co., Division of Devoe and Raynolds Co., Inc., Louisville, Ky.

In general, these resins represent but a portion of the total number of alkyd resins manufactured by these firms. Other alkyd resins, not included, are used primarily for such non-metallic applications as architectural and traffic paints.

Alkyd resins made by other firms will be covered in subsequent articles in this series.

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FINISHING POINTERS

VOLUMETRIC DETERMINATION OF ZINC AND COPPER IN BRASS PLATING SOLUTIONS

By J. R. Luck & E. H. Lindemann

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

THE methods in the literature generally involve separation of the two metals followed by individual determination.[1] A common method involves the acidification of the sample, electrodeposition of copper and titration of the zinc with ferrocyanide using diphenylamine indicator (iron must be absent).[2,3] The method which follows gives accurate quantitative determination of copper and zinc in brass plating solutions. The number of manipulations and the time required are considerably less than in the methods referred to above. This new method also has the advantage that it can be applied to the determination of copper and zinc in their respective cyanide plating solutions. The plating shop analyst may perform all of these metal determinations using essentially the same method, resulting in a reduction in training time, equipment, and supplies.

The disodium salt of ethylene-dinitrilo-tetraacetic acid has been applied to the determination of heavy metals in many plating solutions.[4] This reagent complexes many metals, including copper and zinc. This is, in fact, the biggest disadvantage of the reagent. Several schemes may be used to exclude certain elements from reactions with this class of compounds. They include specific indicators, pH control, use of specific complexones, and exclusion of certain elements before titration by precipitation, complexation, etc. In the proposed method the copper is strongly complexed with ascorbic acid, which does not react with zinc. The copper-ascorbic acid complex is stronger than the EDTA complex and, therefore, the EDTA may not react with copper when sufficient ascorbic acid is present but will react with zinc under the same conditions. The indicator (Murexide) is also a complexing agent, which, when complexed with zinc is yellow but when free is red.

Reagents

1. Ethylene-dinitrilo-tetraacetic acid, disodium salt, dihydrate (EDTA) 0.02M.
2. Murexide indicator. 0.1 gram + 50 grams NaCl.
3. Sulfuric acid. 1 volume H_2SO_4 + 2 volumes H_2O.
4. Ammonium hydroxide, concentrated.
5. Ascorbic acid.
6. Nitric acid, concentrated.

Method

Pipette a 3.0 ml. sample of the brass plating solution into each of two 250 ml. beakers. Under the hood add 5 ml. of H_2SO_4 and a few drops of concentrated HNO_3. Heat and swirl the beakers until the residue is dissolved. Continue heating until fumes are evolved. Cool. Carefully add 150 ml. distilled water. Slowly add concentrated NH_4OH until a permanent blue tinge is obtained, then add 2 ml. excess. To *one* of the beakers add solid ascorbic acid slowly until the blue color changes to amber or clear. This complexes the copper and leaves only the zinc to react with the EDTA. Add about 0.5 gram of the Murexide indicator and titrate the solutions in good light with EDTA.

In the zinc titration the color changes from yellow to red at the end point. In the zinc plus copper titration the color changes gradually from blue to yellow then sharply to red at the end point.

Calculations

Record the ml. used for the zinc titer and the difference between the total titer and the zinc titer (which is the copper titer).

Zinc: ml. EDTA $\times$ Molarity $\times$ 2.93 = zinc metal, oz./gal.

Copper: ml. EDTA $\times$ Molarity $\times$ 2.83 = copper metal, oz./gal.

Experimental Results

Brass plating solution analyses were simulated by using copper and zinc salts as primary standards. Reagent grade chemicals were used.

Added		*Found*	
Cu	*Zn*	*Cu*	*Zn*
29.7 mg.	0.0 mg.	29.7 mg.	0.0 mg.
0.0	32.3	0.0	32.3
29.7	32.3	29.7	32.3
59.4	32.3	59.1	32.3
29.7	64.6	28.4	64.7

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2. Plating, **41**, No. 12, 431 (1954).
3. Principles of Electroplating and Electroforming, Blum and Hogaboom, 3rd Ed., p. 198.
4. Metal Finishing, **57**, 75 (July 1959).

Science for Electroplaters

68. Brighteners

By L. Serota

Smoothing Action

THE ability of some plating baths to produce deposits that are much smoother than the basis metal, a property characterized as smoothing action, has been of profound interest to the plater, since the elimination of surface defects on basis metals, without the necessary polishing process followed by buffing of the electrodeposited nickel, is of immense economic importance.

K. S. Wilson and A. H. DuRose consider the introduction of improved surface-examining devices and development of semi-bright nickel, a method which leaves heavier than average deposits in surface defects, important factors in the process of providing a smooth surface in the plating operation.

G. E. Gardam refers to the smoothing action and reflectivity of electroplating solutions yielding bright deposits as a characteristic property, in which the surface becomes smoother as the deposit becomes thicker, an effect produced when the deposit is thicker in the recesses than on other areas of the plated surface. This process is generally the opposite of that occurring in metal deposition, since the current density for the depression (recess) should be less, considering the greater length of the current path to the bottom of the recessed area; hence, the thickness of the deposit for such areas should be less than elsewhere on the plate.

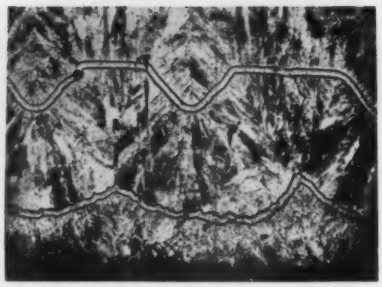


Fig. 2. Deposit from NSB.KC solution. No smoothing action. X100.

Modification of the above condition, in varying degrees, will be affected by the throwing power of the solution. In some instances, as in a cyanide solution, Gardam notes, diminution of thickness at the bottom of recesses occurs.

The term "zero smoothing action" is used by the author when surface imperfections are not reduced or eliminated; "positive smoothing action" is the term applied to deposition in which the surface assumes a smooth appearance, and "negative smoothing action" when the thickness becomes less at the bottom of the recesses. The three conditions are represented diagrammatically in Fig. 1 with the respective types of deposits indicated on a serrated cathode.

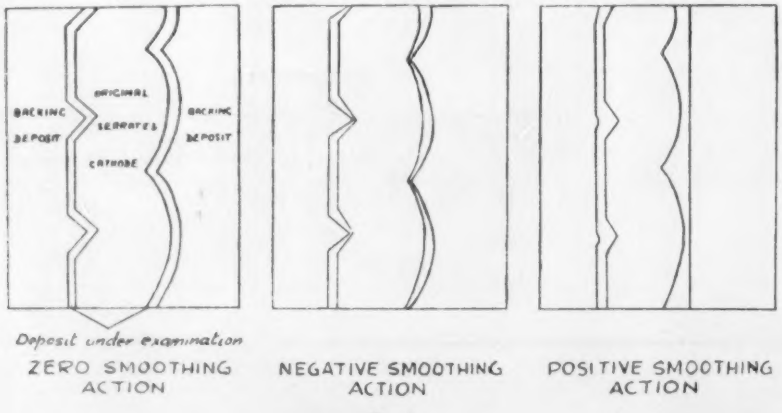


Fig. 1.

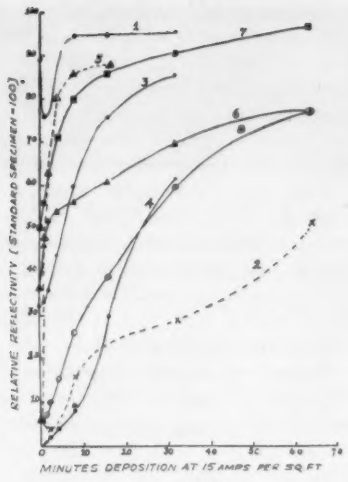
An example of zero smoothing action, obtained by Gardam when nickel was deposited on a serrated nickel cathode from a Watts single salt solution, $NiSO_4 \cdot 6H_2O$, 240 g./l.; H_3BO_3, 30 g./l.; KCl, 20 g./l., designated as a NSB.KC solution, is shown (in cross section) in the photomicrograph (Fig. 2). The significant fact revealed by the photomicrograph for this type of solution is the uniformity in thickness of the deposit, even though positive smoothing action does not result. The Weisberg-Stoddard bright cobolt-nickel solution also showed zero smoothing action. The addition of formic acid, 4-30 g./l., L. Weisberg notes, will produce positive smoothing action.

When the NSB.KC was modified by the addition of 0.25 g./l. cadmium (as sulfate), electrodeposition on serrated nickel cathodes, current density 150 amp./ft.^{2}; 35°C.; pH 5.8, yielded a very strong positive smoothing action. The amount of cadmium in the deposit was 0.7 per cent. A photomicrograph of a section of such deposit is indicated in Fig. 3. Substitution of some of the nickel sulfate in the NSB.KC solution by $FeSO_4 \cdot 7H_2O$, providing a solution containing 29.2 g./l. Ni; 22.1 g./l. Fe (deposit 78.4% Fe; 19.5% Ni), yielded a very strong positive smoothing action.

Fig. 3. Nickel deposit from NSB.KC solution + 0.25 g./l. Cd. Very strong positive smoothing action. X 100.

Reflectivity

When reflectivity measurements were made by Gardam, of polished brass specimens with successive deposits of increasing thickness of nickel, a decrease in reflectivity was noted. Similar results occurred when measurements were made with the above type solution to which sufficient cadmium or zinc was added to give definite smoothing action on serrated cathodes. The author attributes the fall in reflectivity to light scattering, due to a large grain formation with dome-like tops. A Galford



Curve No.	Preliminary Solution	deposit. Thickness ins.	Subsequent Deposit.
1.	NSB.KC	0·000106	Chromium.
2.	NSB.KC	0·000424	Chromium.
3.	NSB.KC	0·000212	NSB.KC+0·1 g/l Zinc.
4.	NSB.KC	0·00075	NSB.KC+0·25 g/l Zinc.
5.	NSB.KC	0·00085	NSB.KC+0·1 g/l Cadmium.
6.	NSB.KC	0·000212	B.N.F. bright nickel bath II (sodium benzene sulphonate).
7.	"Sodium formate"	0·000106	) B.N.F. bright nickel bath I.
8.	"Sodium formate"	0·000424	)(Perminal W).

Fig. 4. Comparative reflectivity of mat deposits with increasing thickness of bright deposits superimposed.

comparative glossmeter was used.

A sharp rise in reflectivity was found to occur, however, when successive bright nickel deposits were superimposed on mat surfaces. Chromium deposits, it was found, increased the luster of the mat deposits. Nickel solutions containing zinc and cadmium gave a more rapid brightening effect than the other bright plating. The mat surfaces in this investigation were prepared by depositing mat nickel on flat, polished brass surfaces.

The reflectivity effect of superimposing chromium or varying thicknesses of nickel from bright nickel baths upon mat deposits of nickel is shown diagrammatically in Fig. 4. The increased brightening that occurs when a bright nickel deposit is applied to a mat one is associated with the change in shape of the surface to produce a smoother surface effect.

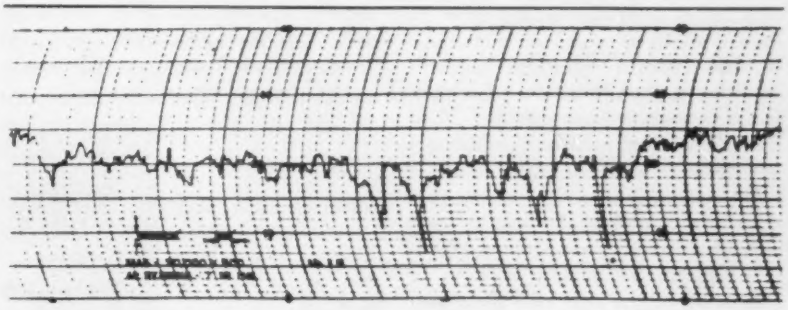
T. E. Such considers the line-filling property of the deposit from a bright nickel plating solution, in the electrodeposition of nickel on a polished (steel) surface, an indication of the increase in smoothness. This effect, increase in smoothness, shown in Fig. 5, is based upon results obtained by Such with nickel plated from a solution on a steel surface previously polished with 120 aluminum oxide (dry), 180 aluminum oxide (dry) and 240 emery (greased). A comparison in smoothness is included with the profile of a nickel deposit plated from an organic bright nickel solution that did not show leveling action.

Semi-Bright Deposits

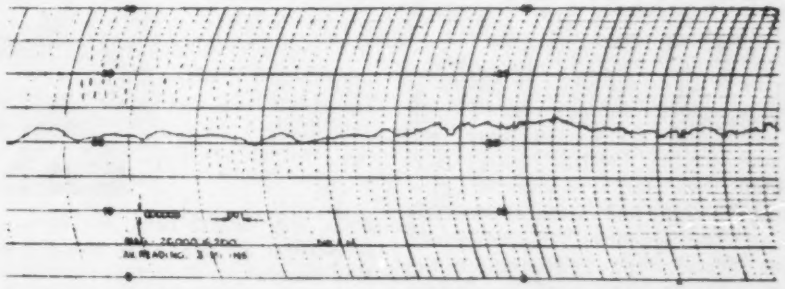
The smoothing ability of a plating solution does not necessarily imply the formation of a bright deposit. Brightness is not always accompanied by satisfactory smoothing action, as Fig. 5 indicates. Some nickel plating solutions capable of producing semi-bright deposits show appreciable smoothing action. In fact, the deposit may be smoother than bright deposits, by minimizing surface imperfections to a greater degree.

A comparative study, for example, of the smoothing effect of different nickel deposits, including proprietary semi-bright and bright nickel baths, made by K. S. Wilson and A. H. DuRose, is indicated in Table 1. Nickel deposits were made on steel (base) panels treated by the liquid honing (vapor blasting) process, so that uniform surfaces of varying coarseness were provided. Plating operations were conducted at 40 amp./ft.^{2} and 140°F. Surface examinations, before and after plating, were made with a surface analyzer. The rms (root mean square) readings (in microinches) indicate the deviation of the surface from a plane. L. Weisberg expresses the view that the average rms value for a surface, based upon measurement with the surface analyzer, may be considered with-

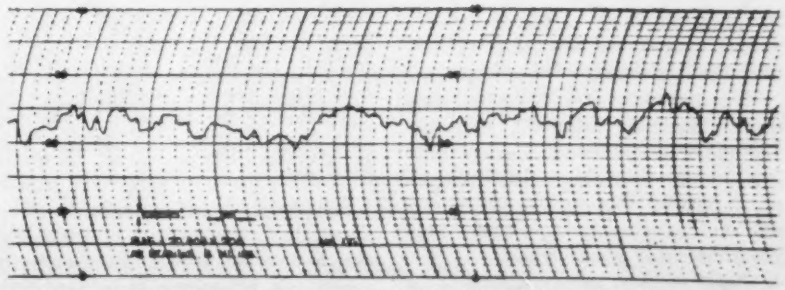
Fig. 5. Profiles of steel surface, before and after bright nickel plating.



Surface of Polished Steel
[Sequence of polishing operations: 120 aluminum oxide (dry), 180 aluminum oxide (dry), 240 emery (greased)].



Same surface after being plated in an organic bright nickel solution with leveling action.



Same surface after being plated in an organic bright nickel solution with no leveling action.

TABLE I. SMOOTHING EFFECT OF DIFFERENT NICKEL DEPOSITS

Type of Bath	Thickness of Deposit inch	Vapor Blast Grit			
		80	140	325	1250
		rms in microinch			
Watts	0.000	>100*	38	6–7	4
*p*H 2.5	0.001	66	27	9	5
	0.002	80	29	21	11
Bright	0.000	>100*	38	7.5–8	4
*p*H 3.0	0.001	80	22	5	1
	0.002	44	23	2.5	1
Semi-bright	0.000	>100*	34–37	8	4
*p*H 3.5	0.0005	77	22	½†	1
	0.001	38	6	½†	½†
	0.002	18	3.5	½†	1
	0.003	15	4	....	..
	0.004	19	2	....	..
All-chloride	0.000	>100*	..	15	..
*p*H 1.0	0.001	80	..	11	..
	0.002	69	..	....	..

*Probably about 120. †Readings probably inaccurate below 1.

in ±5 per cent of the true rms value for that surface.

The ability of semi-bright deposits to fill in imperfections (and reduce amplitude) is evident in the table by the improved smoothing effect attained, in this bath, of even a 0.0005″ deposit of nickel, especially with the finer finishes. Deposits thicker than 0.002″ do not show any marked additional smoothing.

The relatively smoother surface produced by a semi-bright deposit compared to that obtained from a Watts-type deposit, the authors note, is an indication of the ease of buffing and lower drag in this operation. Similar efforts with a Watts-type bath would result in removal of an appreciable amount of nickel.

E. D. Miller and A. H. DuRose, in their evaluation of the buffability of nickel deposits, report that the smoothness of the deposit bears a relationship to the amount of drag developed in the buffing of nickel. Buffability, the authors state, involves luster, coverability, and drag. The term "drag" is applied to the pull exerted by the buffing wheel in contact with the deposit, an effect bearing a relationship to the roughness on softness of the deposit. Depth or number of indentations or ridges in the surface, therefore, determines the amount of fibers (of the wheel) caught, and serves as an indication of the extent of the drag.

Experimentally, scratches of varying depths, made by using 50, 100, and 150 gram weights with a gauge testing machine operating a hard phonograph needle, were produced on the unplated steel panels previously polished on a 180 grease wheel.

Nickel deposits were made from a Watts bath with 10.5 oz./gal. nickel chloride, a high chloride bath, and three proprietary baths containing addition agents. Charts, representing measurements with a profilometer, indicated that deposits from the Watts and chloride baths did not fill in scratch marks. Although the scratch marks were not filled in by the deposit from the bright bath, the surface smoothness of the basis metal was maintained.

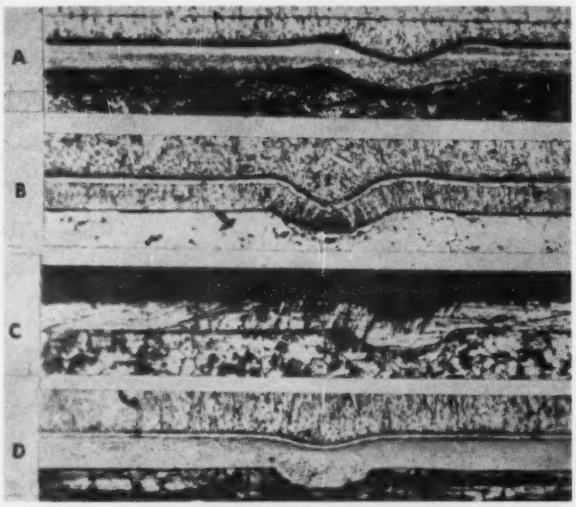


Fig. 6. Scratch filling ability of (A) bright, (B) Watts, (C) all-chloride, and (D) semi-bright nickel deposits. X 250.

The comparative smoothing effect is strikingly demonstrated in Fig. 6 in the cross-sectional view of deposits from the four types of nickel baths studied. The filling property of the semi-bright deposit, labeled D, is evident. Buffing for the semi-bright deposit, accordingly, is reduced appreciably.

Semi-bright solutions may be prepared, T. E. Such states, by the addition to a Watts type bath of organic agents, or by means of a modified cobalt-nickel (Watts) solution. The latter solution, which gives little or no improvement in leveling, will, L. Weisberg reports, upon the addition of formic acid and formaldehyde (40 per cent solution) to a cobalt (about 1 per cent) — nickel solution produce appreciable smoothing action.

For the semi-bright range, the amount of formaldehyde, Weisberg states, may be reduced to an amount that will be just enough to control pitting, about 0.1 oz./gal. The bath should be operated at a pH of 2.3; 160-170F.; current density 40 amp./ft.^{2}

The recommended composition for this type of solution comprises nickel sulfate, 40 oz./gal.; nickel chloride, 4 oz./gal.; formic acid, 2 oz./gal.; boric acid, 5.5 oz./gal.; cobalt sulfate, 0.4 oz./gal.; formaldehyde (40 per cent solution), up to 0.35 oz./gal.

An indication of the saving in both nickel finishing and basis metal finishing with semi-bright nickel deposits, as a result of the smoothing-action for this type of bath, is cited by Such in the case of some steel articles which require polishing to a 240 emery (greased) finish when bright nickel plating is applied, but will require the use of only 120 emery (dry) for semi-bright nickel plate.

The reduced polishing operation for the semi-bright compared to that required for the dull plate, of course, will minimize polishing through to the basis metal. In ductility, semi-bright deposits are greater than fully bright deposits but more brittle than a Watts nickel deposit. T. E. Such likens the semi-bright deposit, both in appearance and physical properties, to a bridge between the fully bright and dull deposit, with the added advantage that usage is not restricted to rigid products.

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gladly received and the sender's name will be kept confidential, if desired.

Electroless Gold

Question: Some months back we read an article which we believe was in your magazine, which told of a process for applying gold to large surfaces by spraying the gold with an organic vehicle and then removing the vehicle by oxidation, leaving the gold deposit.

We have a customer who needs a piece of copper 2′ x 8′, gold plated 0.0002″ thick. Can you give us any help on this?

L. S. W.

Answer: The article referred to was probably the one by Swan and Gostin, which appeared on pages 52-3 of the April 1961 issue of METAL FINISHING. This article described an "electroless" or catalytic process, and would be suggested as the simplest method of applying the desired deposit.

Bright Dipping Brass

Question: We are enclosing two samples of covers. After bright dipping these covers, we get two different shades as you will see by the samples. We believe this is the brass, but would like to be sure. Would you please advise at your earliest convenience.

A. E.

Answer: If the brass coil is examined before the covers are stamped out it will probably be noted that some sections of the coil have a copper color, while others are brass colored. It is believed that the difference in color is due to dezincification during annealing and pickling and it is doubted whether any modification in the bright dipping solution or procedure will have any effect.

Extended time in the bright dip often dissolves away sufficient metal to expose the brass color, but the surface will usually be too rough and pitted to be usable.

Cable Capacity

Question: I am in the process of installing an 18 volt 3,000 amp rectifier. Rather than use bus bar, I am going to use copper cable, which will be covered. The distance from rectifier to tank is 28 ft. I expect to use more than one cable from each pole, and would like to know from you what size cables you would suggest. Whatever help you can give me will be appreciated.

F. A.

Answer: The largest stranded cable convenient to handle is 1 million circular mils. This will carry about 800 amperes. Therefore, four cables will be required for each line, from a 3,000 ampere rectifier.

Carbonate Removal from Cyanide Solutions

Question: Unfortunately, we lost one of your issues publishing a treatment to remove carbonates from alkaline solutions. We wonder whether it would be possible to furnish us with this information at your earliest convenience.

A. S. A.

Answer: Carbonates are removed by freezing out, or by addition of calcium or barium salts. Freezing out requires lowering the temperature to about 30°F., and will remove the excess sodium carbonate above about 8-10 oz./gal. The method has the advantage of introducing no chemicals into the bath, but is not suitable for potassium type solutions. In cold climates, the solution can be stored outdoors in drums overnight.

Barium hydroxide or cyanide, and lime or finely powdered gypsum will precipitate the carbonate, replacing it with an equivalent amount of cyanide, hydroxide, or sulfate. The accumulation of sodium or potassium sulfate, as a result of adding gypsum, does not interfere with operation of the bath. It can be removed by freezing out, if desired. Since alkaline solutions are much less sensitive to the concentration of hydroxide than of cyanide, lime is a favored method.

1 oz. of gypsum will remove 0.6 oz. sodium carbonate or about 0.8 oz. potassium carbonate.

1 oz. of lime will remove 2 oz. of sodium carbonate or 2½ oz. potassium carbonate.

Abrasives in Buffing Compositions

Question: Could you please outline the different types of buffing compositions and their uses. I intend to do some testing in order to cut down our polishing costs, which account for the largest part of our finishing dollar by far, and the information will help me to choose the most efficient cycle.

L. D. R.

Answer: For convenience, buffing compositions can be distinguished according to whether they are used for hard metals such as steel and stainless steel, and for non-ferrous metals. For the former, fused and unfused aluminum oxide are used for the cut-down operation, and unfused aluminum oxide powder for color-buffing. For the highest degree of luster, a green chromium oxide rouge is employed.

For non-ferrous metals, Tripoli compounds are employed for cuttingdown. This is a natural abrasive, containing a high percentage of silica, with a reddish color imparted by the presence of iron oxide. For color-buffing, lime or fine silica compositions are used, while red rouge, a very fine iron oxide, gives the highest luster, especially on precious metals. When a heavy cut and high luster are unnecessary, "cut-and-color" materials are used in a single buffing operation. These contain silica powder or a blend with Tripoli, giving less cutting action than Tripoli alone but more coloring effect.

This is but a rough outline of the subject, and results will be affected radically by the type of binder, type

of buffing wheel, and wheel speed. It is suggested that a buffing composition manufacturer be called upon to provide the service of a sales engineer for assistance.

"Japanning"

Question: Can you furnish or direct us to information on the complete process of "Japanning" such as is used as a finish on springs? We are interested in the material applied, methods for application and equipment required, as well as process costs.

F. D. P.

Answer: This process is very old and is a common name for any of a number of pigmented varnishes producing a rich, brilliant, hard surface on metal or wood. The name is also applied to any varnish, containing a high percentage of resins, which may be added to a paint in order to promote quick drying. The term "japan" is applied specifically to Brunswick Black used in interior decorating in a process known as japanning in which materials, after being varnished, are heated in stoves in order to make them dry and hard.

Japan lacquer is prepared by heating linseed oil with litharge and Prussian Blue and thinning down the mixture with naphtha, turpentine, or other solvent.

For additional information on this process, we are listing companies which may be contacted.

Immersion Ruthenium Bath

Question: We note in the 1961 edition of the METAL FINISHING GUIDEBOOK two formulas for plating ruthenium with current. However, we are interested in an immersion method for our requirement, no formula for which was in the section on *Immersion Plating*. Is there such a formula we could use? A prompt reply would be appreciated.

G. H. P.

Answer: If the basis metal is copper or a copper alloy, ruthenium can be deposited by displacement from a strongly acid solution, at elevated temperature. A suggested formula will consist of 5 g./l. ruthenium (as chloride) plus 250 ml./l. concentrated hydrochloric acid. Immersion at about 95 deg. C., for 30 minutes will produce a coating 0.0001" thick. This thickness, which is very much greater than the usual displacement deposit, is due to porosity. If resistance to tarnish of the basis metal is desired, an immersion gold should follow. However, if the yellow colored surface produced will be unacceptable, an alternative would be immersion in a solution of 1 part ammonia to 2 parts water.

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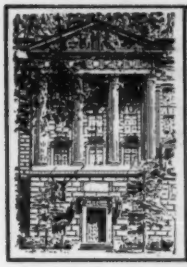

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Hot Galvanizing

U. S. Patent 2,986,808. *June* 6, 1961. *P. E. Schnedler, assignor to Armco Steel Corp.*

A steel body having essentially a one-phase coating of a substantially iron-zinc alloy containing from about .001% to about .35% of aluminum, said alloy coating being ductile and having good paintability and produced by coating said body with zinc containing said percentage of aluminum, and subjecting said coated body to electrical heating from within and maintaining said body in said heated condition for a time sufficient to permit iron molecules to migrate to the outer surface of the coating.

Ultrasonic Cleaning

U. S. Patent 2,987,068. *June* 6, 1961. *N. G. Branson, assignor to Branson Instruments, Inc.*

Apparatus for ultrasonic cleaning comprising: a tank, a body of liquid therein having a surface, transducer means adapted to generate waves of mechanical vibratory energy in said body at ultrasonic frequency, said transducer means being focused to direct the waves of energy produced in the liquid toward a focal point substantially beyond said surface, whereby said waves are reflected back toward an inverted focal point substantially within said body of liquid, and means for supporting an article to be cleaned in the zone traversed by both the direct and the reflected energy waves.

Copper-Tarnish Inhibitor

U. S. Patent 2,987,374. *June* 6, 1961. *H. W. Mumm, assignor to Orchard Paper Co.*

An article of manufacture for inhibiting the discoloration or corrosion of copper-surfaced articles by elements normally present in the atmosphere, comprising an enveloping packaging material for receiving copper-surfaced articles and having substantially uniformly incorporated therein a preparation consisting of at least one water-insoluble fatty acid amide from the group consisting of the amides of oleic, stearic, and palmitic acids.

Caustic Treating

U. S. Patent 2,987,426. *June* 6, 1961. *R. E. Shaw, assignor to Imperial Chemical Industries Ltd.*

In a process involving alkali treatment of a metal wherein the metal is immersed in an aqueous alkali solution with the evolution of undesired fumes or spray, the improvement whereby said evolution of fumes and spray is minimized, said improvement comprising immersing said metal in an aqueous alkali solution covered with a saturated hydrocarbon surface layer which is liquid at the operating temperature, said liquid hydrocarbon being substantially immiscible with said alkali solution, substantially non-volatile and stable at the operating temperature of said solution and inert with respect to the constituents of the solution, both said solution and said surface layer having a surface active agent dissolved therein.

Acid Pickling Process

U. S. Patent 2,987,425. *June* 6, 1961. *R. E. Shaw, assignor to Imperial Chemical Industries Ltd.*

A process of pickling metal which comprises providing an acid pickling solution, covering all of the surface of said solution with a non-aqueous surface layer of inert liquid which is substantially immiscible with said pickling solution and substantially non-volatile and stable at the operating temperature of said solution, including in said surface layer and said pickling solution a surface active agent which is soluble in both said layer and said pickling solution, thereafter passing the metal to be pickled through said surface layer and into said solution, withdrawing the thus pickled metal through said surface layer, and then rinsing said metal with water whereby the surface active agent in said surface layer facilitates the removal of any adherent surface layer.

Coloring Anodized Aluminum

U. S. Patent 2,987,417. *June* 6, 1961. *W. C. Cochran, assignor to Aluminum Co. of America*

The method of pigmenting an aluminum article having on its surface an artificially produced oxide coating, comprising immersing the coated article in an aqueous solution containing at least one chromic salt from the group consisting of chromic bisulfite, chromic oxalate and chromic formate, whereby said oxide coating is impregnated and colored with chromic oxide pigment precipitated from said solution.

Acid Coating Process

U. S. Patent 2,987,427. *June* 6, 1961. *R. E. Shaw, assignor to Imperial Chemical Industries Ltd.*

In a process for the acid coating of a metal by immersing said metal in a heated acid coating solution having volatile or decomposable components therein, the improvement whereby loss of components from said solution by volatilization and decomposition is minimized, said improvement comprising immersing said metal in a hot coating solution covered with a non-aqueous surface layer of inert material which is liquid at the operating temperature, said liquid being substantially immiscible with said acid coating solution, substantially non-volatile and stable at the operating temperature of said bath and inert with respect to the constituents of the bath, both said solution and said layer having a surface active agent dissolved therein, the amount of agent in said solution being sufficient to lower the surface tension thereof to less than 40 dynes/cm.

Anode for Chromium Plating

U. S. Patent 2,987,453. *June* 6, 1961. *A. H. DuRose, assignor to The Harshaw Chemical Co.*

The method of electrodepositing chromium, including the steps of suspending the object to be plated in a chromium plating bath employing a platinum coated titanium auxiliary anode, said auxiliary anode being prepared by electroplating a platinum coating on a titanium base and then

heat treating the coated base at a temperature of 400°C. to 800°C.

Phosphating

U. S. Patent 2,987,428. *June* 6, 1961. *F. P. Heller and R. L. Beamon, assignors to Amchem Products, Inc.*

The method of coating steel which comprises treating its surface with an aqueous solution consisting essentially of the following:

	Quantity
Pyrophosphate from the class consisting of sodium, potassium, ammonium and lithium pyrophosphates	from 0.05% to 13% by weight.
Ferric ion	from 0.0008 part for each part of pyrophosphate calculated as P_2O_7 to saturation of the bath.
Accelerating agent from the class which consists of chlorates, nitrites and peroxygen compounds	equivalent in effect to from 0.2 gram to 10 grams of chlorate per 100 mls. of coating solution.

the solution being maintained at a pH of from 3.2 to 6 and at a temperature not exceeding 120°F.

Conversion Coating — Aluminum

U. S. Patent 2,988,465. *June* 13, 1961. *N. J. Newhard, Jr., D. Y. Dollman and L. Steinbrecher, assignors to Amchem Products, Inc.*

In the production of chemical conversion coatings on a succession of aluminum surfaces where the surface is treated with an aqueous acid solution consisting essentially of a fluorine bearing compound and hexavalent chromium, the method of maintaining the solution in coating condition throughout its operating life which comprises periodically restoring the hexavalent chromium content of the solution to the desired level and replenishing fluorine by adding fluoride from the class consisting of hydrofluoric acid and alkali and ammonium salts thereof, the quantity of fluoride from said class which is added being from 0.4 to 2 parts for each part of chromate (calculated as CrO_3).

Cleaning Composition

U. S. Patent 2,987,483. *June* 6, 1961. *C. E. Brooker, assignor to Pennsalt Chemicals Corp.*

The method of preparing an alkaline cleaning composition which comprises heating 60 to 90 parts by weight of sodium hydroxide which contains 36 to 25% by weight water to a temperature above 148°F. but not exceeding 200°F. to form a molten solution, uniformly dispersing throughout said solution 40 to 10 parts by weight of sodium tripolyphosphate and up to 5 parts by weight of an alkyl aryl sulfonate detergent, and then solidifying the resulting dispersion by cooling to a temperature below 148°F.

Iron-Chromium Alloy Bath

U. S. Patent 2,988,492. *June* 13, 1961. *T. Yoshida*

A process for electroplating a ferrochrome alloy containing from 5 to 40% chromium, comprising: preparing an electrolytic bath comprising an aqueous solution containing per liter substantially from 37 to 200 grams of anhydrous chromic sulfate, from 29 to 185 grams of anhydrous ferrous sulfate, from 32 to 330 grams of ammonium sulfate, from 60 to 264 grams of urea, and from 0.05 to 88.74 grams in total of at least one anhydrous sulfate of a metal selected from the group consisting of divalent manganese and trivalent aluminum, the ratio of the trivalent chromium to divalent iron ranging between 0.3 and 3.2 to 1; keeping the aqueous solution at a temperature of between 25 and 55°C. for at least 4 hours after the preparation thereof; and subjecting said electrolytic bath to electrolysis at a temperature of 25 to 55°C.

Plating Barrel

U. S. Patent 2,988,497. *June* 13, 1961. *R. E. Belke, assignor to Belke Mfg. Co.*

An eccentric electroplating barrel unit.

Continuous Vacuum Coating

U. S. Patent 2,989,026. *June* 20, 1961. *J. H. Gardner and C. A. Baer, assignors to National Steel Corp.*

Apparatus for coating a substrate in a vacuum, said apparatus comprising a plurality of vacuum chambers.

Automatic Plating Machine

U. S. Patent 2,989,060. *June* 20, 1961. *V. Finston, assignor to The Meaker Co.*

A processing machine for advancing work carriers through a series of processing stations.

Electrostatic Spraying

U. S. Patent 2,989,241. *June* 20, 1961. *D. H. Badger, assignor to Ransburg Electro-Coating Corp.*

An apparatus for electrostatically spray coating a grounded article, said apparatus including an atomizing device provided with an annular atomizing edge.

Inorganic Coating

U. S. Patent 2,989,418. *June* 20, 1961. *R. L. Harbaugh, assignor to Inland Steel Co.*

A process for treating an article having a surface of a metal selected from the group consisting of zinc, aluminum, and alloys thereof to protect the surface against corrosion, which comprises the steps of coating the surface with an aqueous solution of an alkali metal silicate, drying to form a relatively insoluble and incompletely dehydrated silicate film on said surface, and thereafter impregnating the silicate coated surface with an aqueous chromic acid solution, said incompletely dehydrated silicate film containing sufficient water so that at least a portion of the alkali metal silicate is converted to silica gel by the action of said chromic acid solution.

Dyeing Chromated Aluminum

U. S. Patent 2,989,427. *June* 20, 1961. *J. D. Noonan and J. E. Loughlin, assignors to Allied Chemical Corp.*

The process of forming a colored layer on the surface of a metal from the group consisting of aluminum and its alloys, which process comprises treating the aluminum with a chromate coating solution containing a lake-forming substrate to form a chromate layer thereon and thereafter dyeing said layer with a cationic dye to form a water-insoluble lake with the lake-forming substrate integral with said layer.

Continuous Anodizing of Sheet

U. S. Patent 2,989,445. *June* 20, 1961. *A. J. Lloyd and J. B. C. Lloyd, assignors to Lloyd Metal Mfg. Co., Ltd.*

A process for continuous anodiza-

tion of only one surface of an aluminum sheet which comprises passing an elongated aluminum sheet longitudinally and unidirectionally through a processing zone, treating one surface of said sheet with a cleaning solution, rinsing and wiping said surface, passing said sheet through an anodizing zone wherein a substantial predetermined area of said one surface is contacted with a flowing anodizing electrolyte to form an interface thereon, contacting the other surface of said sheet with an electrode disposed in substantially opposed and coextending relation to said interface, passing an electric current of uniform density through said interface by means of the electrolyte and electrode to anodize the one surface of said sheet, removing the electrolyte from said sheet after anodization, and sealing the anodic coating formed on said surface.

Brightener for Copper and Alloy Baths

U. S. Patent 2,989,448. *June* 20, 1961. *D. R. France*

A brightener for plating a metal selected from the group consisting of copper, copper-tin and brass comprising the following in the following proportions, sixteen ounces sodium hydroxide, six ounces arsenic trioxide, six tenths ounce lead subacetate, three ounces sodium stannate, two tenths ounce vanadium pentoxide, one and six tenths ounces ethylenediaminetetra acetic acid tetrasodium salt, three and two tenths ounces alkyl-aryl amine type wetting agent and water sufficient to make one gallon of brightener.

Zinc Bath Brightener

U. S. Patent 2,989,449. *June* 20, 1961. *R. W. Mackey and D. A. Swalheim, assignors to E. I. duPont deNemours & Co.*

A single-phase liquid additive for an aqueous alkaline cyanide-zinc plating bath comprising by weight, 10-20% of an alkali metal thiocyanate, 5-25% of an alicyclic compound selected from the group consisting of alicyclic alcohols and alicyclic ketones, 2-10% of a protective colloid, 6-20% of a water miscible aliphatic alcohol having 1-6 carbon atoms, 0.50-1.0% polyvinyl alcohol; 5-25% of a substituted aromatic aldehyde selected from the group consisting of anisaldehyde, veratraldehyde, hydroxybenzaldehyde, piperonal and mixtures thereof and 20-70% water.

Nickel-Zinc Alloy Bath

U. S. Patent 2,989,446. *June* 20, 1961. *M. B. Hammond and G. B. Bowman, assignors to Rockwell-Standard Corp.*

In a method of plating articles using an electrolyte which plates out a zinc-rich alloy said electrolyte having a pH between about 1 and 3 and temperature between about 70°F. and 165°F., a nickel metal content of 8 to 10 ozs. per gal. and a zinc metal content of 6 to 8 ozs. per gal., at least 50% of the total of the nickel and zinc metal concentration in the electrolyte being in the form of chlorides, the improved steps comprising passing current through the article and the electrolyte for a time period within which the current flow is being periodically reversed to make the article once anodic and next cathodic in that bath to deposit a nickel-rich alloy on the article, wherein the current density is of a value between 20 to 600 amps./sq. ft. in each direction and wherein on alternate anodic and cathodic pulses the anodic flow is sustained for at least 2 seconds, with the cathodic flow being sustained for a duration sufficient to apply to the bath coulombs in excess of the anodic flow but not over 30 seconds and repeating said anodic and cathodic reversal of current flow at least several times in the duration of said time period.

Nitric Acid Inhibitor

U. S. Patent 2,989,485. *June* 20, 1961. *L. H. Eilers, assignor to The Dow Chemical Co.*

A corrosion-inhibited aqueous nitric acid solution comprising nitric acid and, as a corrosion inhibitor therefor, about 0.125 to 1.0 per cent by volume of a sulfur-containing compound selected from the group consisting of lower alkanedithiols, furfurylthiol, lower mercaptoalkanols, lower dimercaptoalkanols, and lower thiolalkanoic acid.

Hot-Dip Coating

U. S. Patent 2,989,944. *June* 27, 1961. *A. W. Harris and A. H. Ward, assignors to United States Steel Corp.*

An apparatus for applying a coating metal to the surface of a metal strip by a continuous hot-dip process.

FOREIGN LITERATURE

Investigations on Electropolishing of Heat-Resistant Nickel Alloys

G. Haeussler & V. Paetzold. *Neue Huette*, (Leipzig, Germany) **5**, No. 11, 665.

A search of the technical literature was conducted in connection with the electrochemical processes occurring during electropolishing and etching of nickel and chromium. Electropolishing tests were conducted on heat-resistant nickel-chromium alloys, using various electropolishing electrolytes and various treatment techniques. Definite proof was obtained that the application of the electropolishing method of treatment offered certain advantages as compared with normal hand polishing and chemical etching treatments usually applied. For the first time in this research, the authors applied the method of periodic electropolishing, with satisfactory results. The advantages of the electropolishing techniques are particularly pronounced with the nickel-chromium alloys, but careful control is required because continuous metal texture control must be exerted during the course of production. It is considered that, with further systematic investigation of the electropolishing process for this specialized application, improvements in the method of working and in the results obtained can be achieved.

Electrolytic Brightening of Silver in Baths with Sodium Thiosulfate Formulation

V. N. Nikulin & M. S. Zypin. *Zurnal Prikladnoj Chimii* (Russia) **33**, No. 2, 469.

As is known, baths on a cyanide basis have been used previously for the electrolytic brightening of silver and silver-plated surfaces. The brightening (polishing) action which is achieved in these electrolytes is very good. As cyanide-containing baths are poisonous, tests were conducted with other bath compositions.

In these tests it was established that baths formulated with thiosulfate give a degree of polish and surface cleanness which is superior to those from

miniature 10 and 25 g.p.h.
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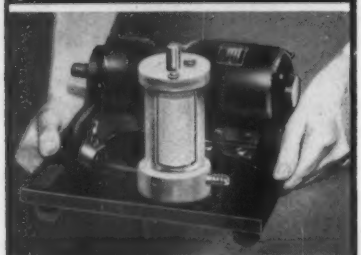

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the cyanide bath. The brightening mechanism is explained by a continuously repeated process of formation and resolution of thin films on the anode surface.

Research on the Mechanism of the Sulfur Inclusion in Electroplated Coatings

A. A. Sutjagina. *Doklady Akademii nauk SSSR* (Russia) **131**, No. 1, 133.

Additions of surface-active compounds (wetting agents) were made to electroplating baths; the addition agents were of a type to influence the deposited metals. In particular, it was desired and anticipated to induce brightening formation and leveling action. In the present research, an investigation was made of the influence of addition agents of the type which contain sulfur, on the structure and characteristics of electroplated nickel, cobalt, zinc, and copper coatings. The amount of sulfur incorporated in the cathode deposit and the occluding mechanism were likewise investigated.

These researches were conducted on thiourea, alkylthiourea, beta-naphthalenesulfonic acid, and thiosulfuric acid. In the case of nickel and cobalt, it was found that no physical absorption occurs. For the most part, the sulfur is embodied as sulfide. In the case of zinc coatings, the sulfur is only absorbed.

Improved Equipment for Internal Chrome Plating and Anodizing of I. C. Engine Cylinders

N. M. Antonow. *Westnik Maschinostroenija* (Russia), **40**, No. 5, 66.

As is known, during the electroplating treatment of the internal walls of hollow component parts, in this case i. c. engine cylinders, operational difficulties are encountered because the distribution of the current lines of force in the bath (throwing power) during electrolysis is poor with respect to that portion of the cathode surface not in the direct actional field of the anode. Because of this fact, it can happen that cylinder walls are only partially coated with a chromium plate.

This drawback can be avoided by the skillful use of auxiliary anodes. The technician generally employs a suitable arrangement which he has built-up himself. Details are given of a suitable design and layout of such an arrangement of auxiliary anodes, as devised and used by the author, in Russian large-scale practice, which is capable of general application in this specialized plating field. The plating rack employed consists of the holder for the component part being chrome-plated, and the support gear for the auxiliary anodes and for the necessary masking screens for the external part of the cylinder. Diagrams are given of the layout which is protected in the Soviet Union by Patent #91,635.

Aluminum Castings for Anodizing

E. A. Block & H. Arbenz. *Aluminium Suisse* (Switzerland). **11**, No. 1, 34.

It is advisable for the customer to indicate on his order the fact that castings are intended to be used for processing by an anodizing treatment. If it is definitely known in the foundry that the aluminum castings are going to be given such an anodizing treatment, then special measures can be adopted in the foundry, and particular attention can be given to ensure that a satisfactory anodizing effect can be obtained.

Casting defects, such as micro-cavities, coarse grain formation, oxide inclusions, hard particle inclusions, and pitting, are disadvantageous in every case to the satisfactory formation of the oxide coating. Because of their overriding importance to the success or failure of the anodizing stage, a lengthy, detailed discussion is given of these defects in the castings, their causes, and their avoidance and prevention, to a very great extent. The report incorporates numerous, outstandingly useful pictures which are very instructive.

Process for Investigating the Internal Stresses in Plated Coatings

A. T. Sanzharowski. *Zurnal Fizicesko Chimii* (Russia). **34**, No. 9, 2115.

In many cases, during electrodeposition of metals, the hydrogen which is formed at the cathode is also codeposited with the metal. This can produce stresses in the cathode metal, which can be sufficiently great so as to produce deformation. The hydrogen is also adsorbed however, by the basis metal.

The more hydrogen the basis metal is able to adsorb, the less passes into the coating. If the basis metal adsorbs no hydrogen, or only a small amount, then the main portion passes into the cathode metal film. Methods are described to investigate the internal stresses in the coating.

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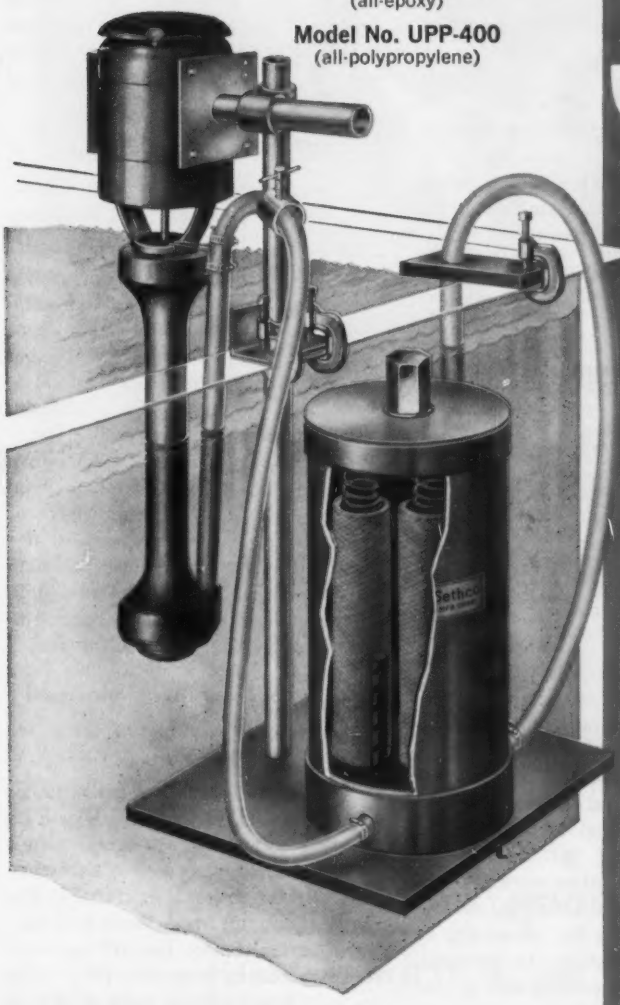

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- Pump fits anywhere on tank, saves floor space, (5½" diam. 4½" immersion depth); minimum displacement in tank.
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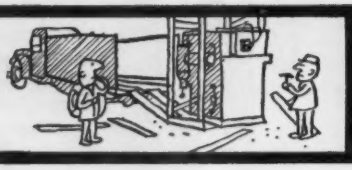


NEW

METHODS, MATERIALS AND EQUIPMENT FOR METAL FINISHING INDUSTRIES

Rustproofing Oil

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

Entek RPO-12, a thin, organic liquid which gives improved protection to steel surfaces, is designed to provide temporary rustproofing to parts in process between manufacturing operations, to parts in storage, or to parts during shipment.

Plain carbon steel dipped in the full strength liquid will withstand 40 hours exposure to salt spray (using Federal Test Standard No. 151), or more than 45 days exposure to tropical humidity tests (100% humidity at 100°F.) it is claimed. Due to its water-displacing ability, any rust-producing moisture remaining on iron and steel after cleaning, blackening, or other wet-processing is replaced by a thin rust-inhibiting film. The material has very low viscosity and drains freely from work upon withdrawal; drag-out losses, and operating costs are thereby reduced to a minimum.

The product may be applied by dipping, spraying, brushing or tumbling. For maximum rust protection of up to one year and optimum water displacing ability, it is advised that it be used at full strength. For more limited rust protection, it may be diluted with an equal volume of safety solvent.

The oil has shown superior resistance to moist acid and alkaline fumes from pickling and aluminum etching solutions. It is not recommended for protection against outdoor exposure.

Organic Finish

In Chem Co., Dept. MF, 2627 N. Mutter St., Philadelphia 33, Pa.

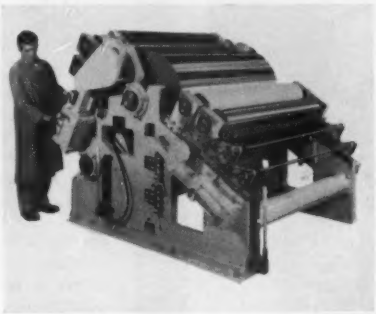
A new clear, colorless coating for aluminum, #7122 was designed primarily for the protection of architectural aluminum during building erection, but may also be used for the protection of all ferrous and non-ferrous metals.

It polymerizes to a tough mortar and acid-resistant film. When dipped, pieces dry to handle in less than four minutes. Although it is a polymerizing type coating, it needs no curing agents and requires no baking. Vinyl plasticizers do not attack the film. Therefore, sticking and blackening problems frequently encountered in aluminum window manufacturing, for example, are eliminated.

The material provides a highly efficient coating, with an excellent sheen, at minimum cost. It is packaged in 55 gallon drums, 5 gallon and 1 gallon cans. Specific data and sample material are available upon request.

Roller Coater

Faustel Inc., Dept. MF, Butler, Wis.



A new line of heavy-duty roller coating and laminating equipment is capable of running steel or aluminum strip up to 16 ga. in thickness, and is available in widths up to 48". The line includes both two- and three-roll coaters in addition to laminator/embossers for thermoplastics.

The two-roll or prime coater is capable of both direct (straight) or reverse roller coating for either top or bottom side application. An outstanding feature of this coating unit is that each of the seven rollers operates through an individual variable speed synchronous motor drive with its own frequency regulator. Optional equipment includes individual pneumatic throwoffs with positive return for all rollers.

Direct Plating on Aluminum

Paco, Inc., Dept. MF, 10 Avenue C, Newark, N. J.

A new silver plating method for aluminum is claimed to eliminate the need for an intermediate coating. The silver is atomically bonded to the aluminum, and finished parts can be raised to the melting point of the aluminum without any possibility of forming blisters. Parts with as much as three thousandths of an inch deposit can be compressive bent without danger of flaking or chipping, it is stated.

Bright Dip for Cadmium

Allied Research Products, Inc., Dept. MF, 4004 E. Monument St., Baltimore 5, Md.

Iridite #4L-1 is a true single dip which will produce a bright, clear finish on cadmium barrel plated work or rack plated work. It is easy rinsing and will stand transfer times of 30 to 40 seconds without cloudiness or staining, it is stated.

The finish provides excellent corrosion protection and retains good solderability even after long periods of storage. This new bright dip is also extremely economical, since minimum concentrations can be used to obtain maximum brightness and additions run longer from one makeup to the next.

Abrasive Tumbling Compound

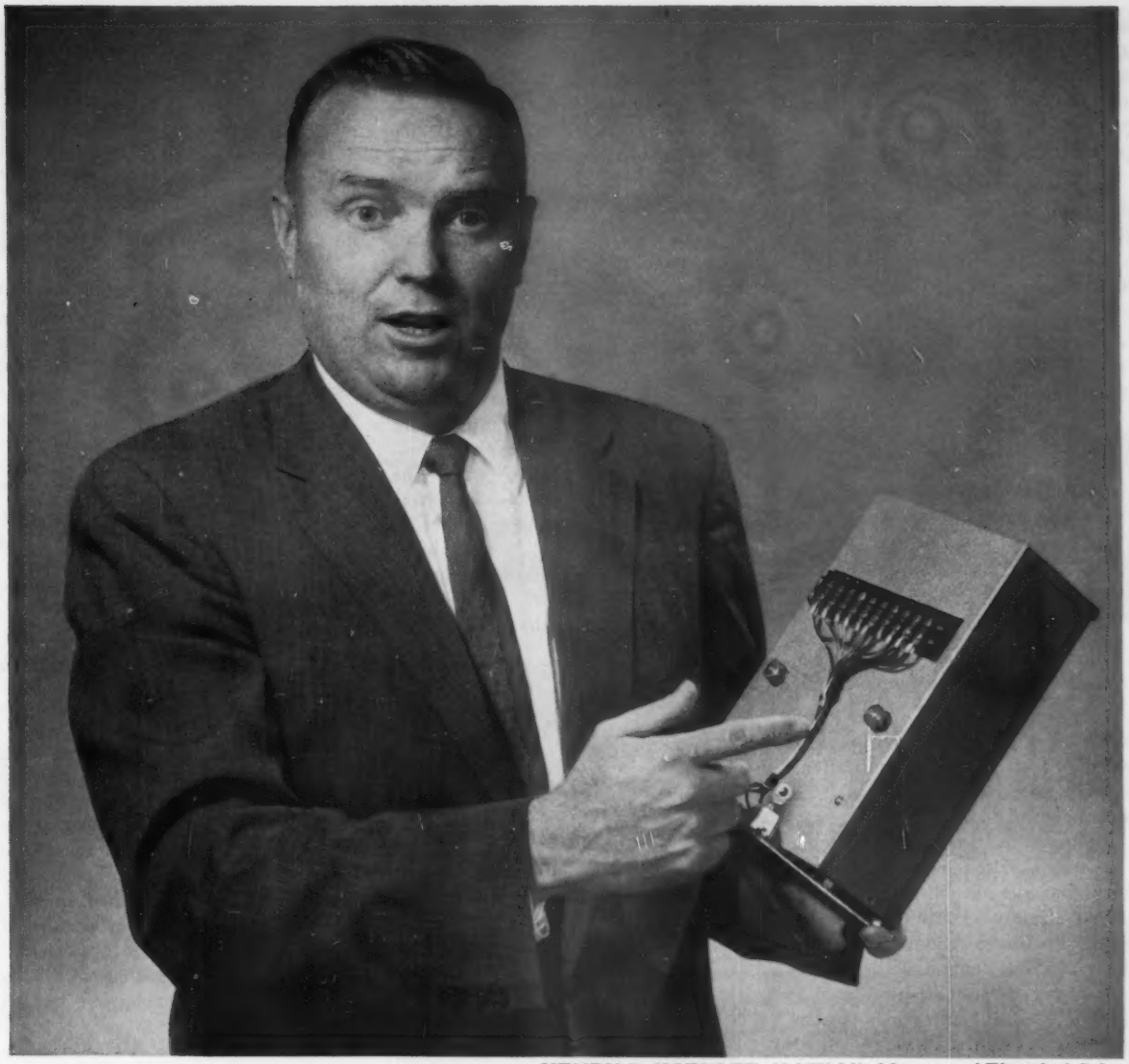
Frederick Gumm Chem. Co., Inc., Dept. MF, 538 Forest St., Kearny, N. J.

A heavy, fast cutting abrasive tumbling compound, CLEPO 205-W will effectively cut even the toughest metals such as carballoy, as well as extremely hard surface scales, it is claimed. The material will not break down in a matter of several hours, but will maintain its sharp cutting properties for periods up to 30 hours without recharging with additional compound. Maximum stock removal can be obtained with this compound in shorter times than with conventional tumbling operations.

Neutral, Pure Gold

Technic, Inc., Dept. MF, P.O. Box 965, Providence, R. I.

Orotemp 24 is a new 24-karat neutral electronic grade gold salt with broad applications in the electronics field. It produces a completely stress-free, ultra-pure 24 Kt. satin bright de-



HENRY B. KOEHLER, H-VW-M's Manager of Electrical Sales

Now...in automatic plating rectifiers

A package of good news for platers!

It's the new *control package* from H-VW-M . . . and here's what it offers you:

Less Downtime, Fewer Rejects. Automatic current limiting is standard, not an extra. Unit won't shut down on normal overloads and shorts.

Grow-Ability. When you need more power in the future, simply connect new units in series or parallel. *No additional controls are needed.*

AVS or ACC. (automatic voltage stabilization, automatic current control) . . . with current limiting . . . are both available at flick of selector switch.

Also yours with this new package control: the advantages of smaller size, less weight, no moving parts. *And the price is hundreds less than you'd pay for the same features in separate rectifier units of conventional design.*

Contact H-VW-M for full details.

H-VW-M *Progress in metalfinishing through advanced processes • equipment*

Hanson-Van Winkle-Munning Company, Matawan, New Jersey • Offices in Principal Cities.
Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco

posit, which is extremely ductile and tight grained and has exceptional heat and corrosion resistance. Further, the salts contain no brighteners or free cyanide. The bath is economical to operate and easy to maintain.

The gold fuses perfectly with gold-silicon eutectic alloy without discoloration, and plates directly on stainless steel, Monel, Kovar, and other alloys. Other characteristics include:

It is extremely ductile. For instance, a deposit of 0.001″ on 0.020″ diameter wire will withstand bending around a 0.040″ mandrel.

It meets all military specifications for Class 1 24 Kt. plates.

Solderability remains perfect, even after prolonged storage.

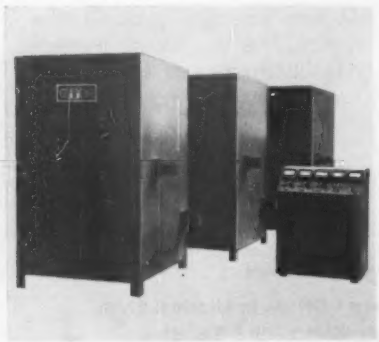
Resistance to sulfides and salt spray is exceptional.

Automatic Control Rectifiers

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

A complete new line of automatically controlled silicon rectifiers for high current, low voltage applications, ranges in power from 1,000 to 10,000 amperes and 6 to 100 volts.

The main feature of the new line is a transistorized control package, which includes a silicon controlled rectifier and provides either automatic current or voltage stabilization. This means complete, automatic control of the rectifier output for any possible application. The control also has an automatic current limiting feature which prevents the unit from being overloaded under normal overload and short circuit conditions. Under these conditions, the unit continues to operate; it will not shut down. The current limiting feature allows the addition of future automatic voltage stabilized rectifiers on the same DC bus without the need for additional controls. No other manufacturer yet offers this feature.



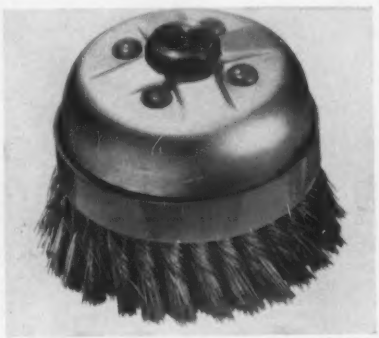
The control panel includes only five parts (excluding two fuses); starter, package control, two control transformers and a protection relay.

Heavy Duty Cup Brush

Brush Div., Pittsburgh Plate Glass Co., Dept. MF, 3221 Frederick Ave., Baltimore 29, Md.

A new heavy-duty cup brush, designed for use on high speed pneumatic and electric-portable tools, is being manufactured by a unique lock-rivet process in which all brush parts are riveted together as a unit, thus eliminating the possibility of slippage. The process also provides positive drive and brushing action.

Both threaded and plain arbor holes will be available. A unique feature of the cups with plain arbor holes is a hex-shaped recess on the inside of the



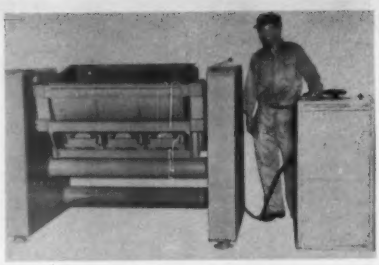
brush which permits the spindle retaining nut to seat, thus locking the brush to the tool spindle. This is an additional safety factor which contributes to positive drive.

The new cup brushes are being manufactured with various gauges of wire and are also available with removable steel bridles. The bridle prevents excessive flare at high speed when the brush is new. It can be easily removed when the wire ends wear down, giving additional hours of brush life.

Vibratory Finisher

Vibrodyne Div., Globe Industries, Inc., Dept. MF, 125 Sunrise Place, Dayton 7, Ohio.

A new 6 cu. ft. capacity vibratory finishing machine uses a unique resonant electro-magnetic system to give shaking forces up to 50Gs, and features only one moving part — the tub. Shaking force is set by a single knob,



from 0 up to 5/16 inch amplitude, and power is standard 220, v.a.c. operating through three pairs of epoxy-compound-impregnated and encapsulated heavy-duty magnets. The suspension is such that a continuous rotary turnover motion provides 100% scrubbing action between media and parts, eliminating packing. Air-dumped tub is 37″ x 20″ x 15″ deep and holds a 750 lb. charge. The 2750 lb. machine does not need to be bolted to the floor.

Stainless Steel Descaler

Fidelity Chem. Prods. Corp., Dept. MF, 470 Frelinghuysen Ave., Newark 12, N. J.

A single solution to be used for immersion bright dipping and descaling stainless steel at the same time, #205 offers a simple means of obtaining bright finishes on stainless steel, at the same time holding close tolerances. The removal of both welding and heat treating scale also is accomplished. In addition, the entire process is performed without the use of current.

The product also has proven to be highly effective in removing tarnish from copper and brass with a minimum amount of metal loss. It also is an excellent descaling and semi-brightening material for Kovar and other high nickel alloys.

The toxicity of the solution is at a low level due to the elimination of hydrofluoric acid and other fluorides often found in other bright dipping formulations.

Aluminum Coatings Tester

Twin City Testing Corp., Dept. MF, 533 S. Niagara St., Tonawanda, N. Y.

In addition to gaging non-conductive coatings on non-ferrous basis metals (such as aluminum and copper), the Type EC Permascope offers a non-destructive means of measuring: (1) the thickness of a non-ferrous metal on a non-ferrous base, (2) the thickness of a non-ferrous coating on a non-conductor, and (3) conductivity of a non-ferrous metal.

A compact, portable unit measuring 9″ x 6½″ x 6½″, the unit can be used wherever there is a 110 volt ac outlet. It operates on the well known eddy current test principle. However, the instrument has a unique feature in that its electronic circuitry allows compensation for conductivity variations of the basis metal which would otherwise produce erroneous readings.

Equipped with two direct-reading scales, the standard model has thickness measurement ranges of 0-0.001″ and 0-0.005″. A modified version is available with a thickness measurement range of either 0-0.001″. or 0-0.005″ plus a conductivity measurement range of 16-110% IACS.

Anodized aluminum plates and plastic foils in accurately determined thicknesses as well as a copper standard are furnished for calibrating the instrument. Slip-on adapters can be provided (optionally) for measurements on cylindrical surfaces and narrow strips.

Plating Rectifiers

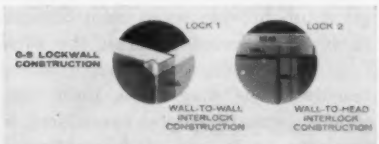
Gates Electronic Co., Dept. MF, 2243 White Plains Ave., Bronx, N. Y.

A new line of low cost, full power units for electroplating, range from 10-200 amps. and 8-15 volts.

All models feature voltmeter and ammeter, powerstat voltage control, 2% voltage accuracy and conservatively rated components and construction for long trouble-free life.

Plating Barrel

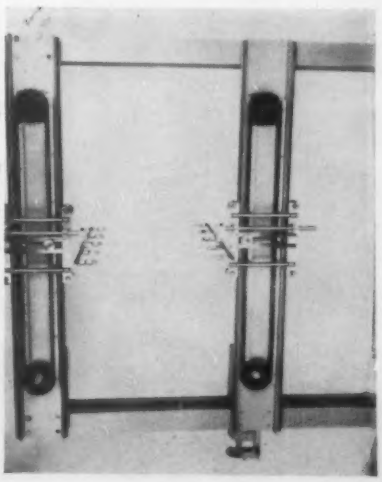
G-S Equipment Co., Dept. MF, 15583 Brookpark Road, Cleveland 35, Ohio.



The Lockwall plating barrel features a double-locking construction, each side wall being mortised and welded into the adjoining wall, and the ends of all walls being mortised and welded into the barrel heads.

This construction provides for exceptionally high strength and long trouble-free service life, as well as much lower original cost than barrels of other construction, it is claimed.

The new construction is available in both new and rebuilt barrels in Plexiglas and polypropylene.

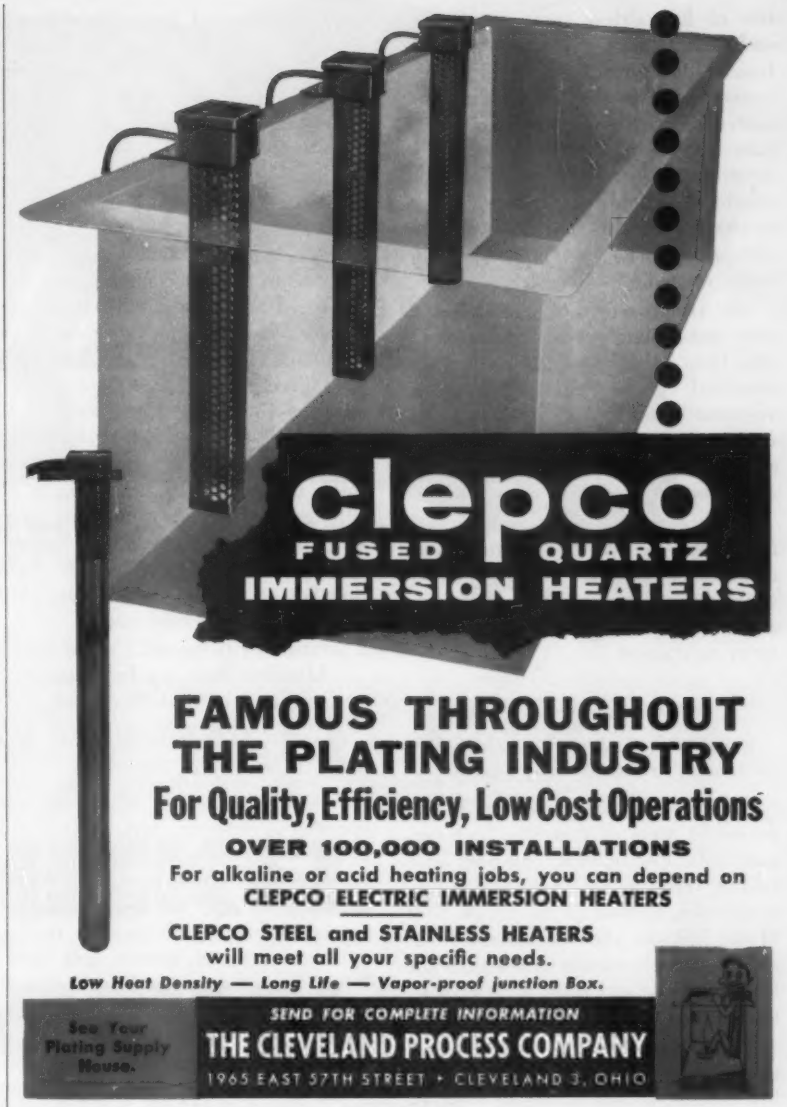


Airless Spray Reciprocating Unit

Spraymation, Inc., Dept. MF, 25 Amity St., Little Falls, N. J.

A line of high speed transverse spray machines designed especially for use with airless spray equipment, features twin carriages with manifolded nozzles for up and down spraying, driven by a common adjustable speed drive.

The model shown is fitted with two



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sets of five airless spray nozzles on each manifold, supplied with material from a high pressure paint valve. This system permits the use of multiple controlled nozzles, giving a wide spray pattern, allowing a fast speed of reciprocation due to decreased carriage weight. Manifolds are easily removed or changed for different materials, and only a single hose connection is generally needed.

The reciprocating unit is of heavy-duty construction with strokes available from 3 to 24 feet. Explosion-proof electrical controls give instantaneous response to on and off signals, eliminating the wasted overspray usually associated with air-controlled reciprocating units.

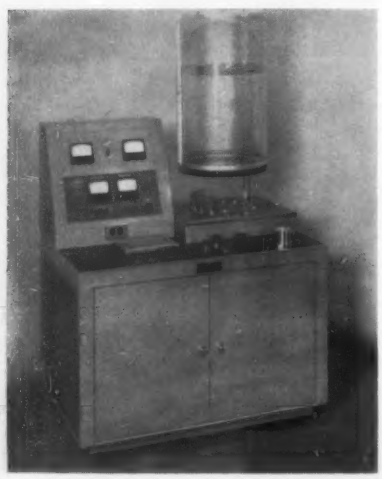
Other models include single carriage units, vertical spray units, and twin head machines for two-component catalyst spraying. Other machines are available for use with conventional spray equipment.

Vacuum Coating System

Vacuum Specialties, Inc., Dept. MF, 34 Linden St., Somerville, Mass.

Features most often specified by experienced users of thin-film, high-vacuum coating equipment have been built into a versatile new bell-jar vacuum evaporator. Known as the Series 2100 Model VSC-20, the self-contained 32-inch desk-high console is designed for laboratory use and small-parts production coating.

The console is arranged to permit the operator to view the work and instruments, to manipulate all controls, and to service the cold trap from a single standing or sitting position. An electric hoist with two-hand safety control raises and lowers the 18-inch-diameter bell-jar and its perforated steel safety guard. The hoist makes the unit easy for women to operate, an important consideration for production applications such as transistor coating.



The precision-ground baseplate and the high-vacuum section of the pumping system are of stainless steel, highly polished to prevent contamination and to speed outgassing. The vacuum pumping system employs a power-operated main valve of new design that seats directly on the baseplate to minimize the volume of system exposed to atmosphere during batch cycling. The standard pumping system exhausts the entire unit to 2×10^{-5} mm Hg in 30 minutes, and produces ultimate pressures in the 10^{-6} range as measured by ionization gauges in the main chamber or vacuum manifolding (but not looking at the cold trap).

Alkaline Solvent for Rust, Oil, and Paint Removal

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

An alkaline solvent which, in one operation, removes rust, paint, oil, grease, and shop soil from metals, Endox L-76, is a non-flammable liquid combination of solvents, chelating agents, and strong alkalies for the removal of rust, oil, grease, and paint. It can be used for soak cleaning of oily, smutty, rusty steel prior to phosphating, blackening, or painting. It penetrates into blind holes and inbetween adjacent flat surfaces. It can also be used for cleaning copper and brass and removes tarnish in addition to soil. The material removes some heat scales from copper and loosens other types of scales sufficiently so that subsequent acid pickling is considerably shortened.

The product is effective as a hot alkaline paint stripper. It rapidly and economically removes many baked synthetic enamels, particularly phenolic modifications, from steel, copper, brass, and magnesium. The surface is left clean and ready for reprocessing.

The stripper is used full strength at temperatures of 170° to 220°F. Work to be cleaned, derusted, or stripped of paint is simply immersed in the hot bath until the metal surface is clean. Usually 1-5 minutes is sufficient for cleaning; 5-15 minutes is sufficient for removal of rust, grease and paint.

Centrifugal Enameler

Leon J. Barrett Co., Dept. MF, P.O. Box 378, Worcester, Mass.

A completely air-powered centrifugal enameler for applying paint, lacquer and many other types of coating to small parts complies with safety codes and provides full control over film thickness of almost any type of coating. Although these enamelers were designed primarily for paints and lacquers, they can safely handle baking enamels, air-drying enamels, synthetic paints, liquid waxes, lubricants, rust inhibitors and many other types of new plastic films.

To provide easy handling of heavy loads by hand or by hoist, the enamelers are top-loading and, because the entire operation is performed within the machine, there can be no spilled paint. The entire system is simple to operate; filling and draining are controlled by a single valve; speed of rotation is adjusted by a needle valve; the same lever which locks the lid starts the motor. As a result, neither operating nor maintenance personnel need special training or skills.

Vibratory Finishing Attachments

Minnesota Mining and Mfg. Co., Dept. MF, 900 Bush Ave., St. Paul 6, Minn.

Five side tubs and a divider for the main tub provide seven compartments to finish different parts at the same time in a Vibrahone vibratory finishing machine. The piggy-back units save time, labor and capital investment in finishing small runs of different sized parts. The steel side tubs are lined with rubber to cushion work pieces.

Piggy-back tubs are optional with the 1½ cu. ft. machine, but attachments can be made to fit any size. Either two, three or five piggy-back

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tubs can be attached. The tubs are detachable and tilt for easy draining.

Ultrasonic Cleaner Unit

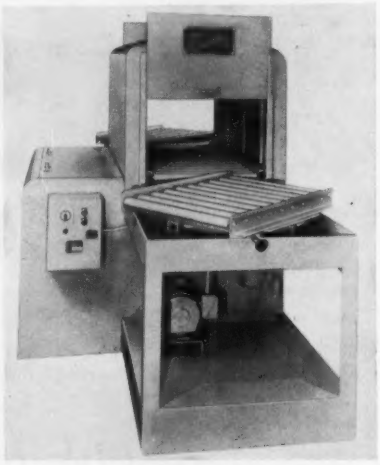
Mettler Electronics Corp., Dept. MF, 114 W. Holly St., Pasadena, Calif.

Operating from a 5-ampere input, this new 5 gallon cleaner develops a generator peak output of 1200 watts at 40 kc, and 4000 watts at 20 kc. The higher peak produces an impact that cleans with exceptional thoroughness and speed. Since power is produced at 20 kc and 40 kc, energy is distributed evenly throughout the entire tank in both the horizontal and vertical planes. The unit develops peak power predominantly at 20 kc. Operation at this low frequency is unusually efficient and economical. Objectionable noise is eliminated.

Designated the Cavitator 20/40, unit features an electrostrictive transducer, automatic timer, and automatic power control. Generator and transducer are so designed that tuning is unnecessary. Standard components are used extensively, all conservatively rated. Tank and cabinet are stainless steel. Size of the cleaning tank is 14″L. x 9″W. x 9¾″D. Overall dimensions are 25″L. x 10¼″W. x only 12″H.

Spray Washer

Waukee Engineering Co., Inc., Dept. MF, 5150 N. 35th St., Milwaukee 9, Wis.



A new swivel table, power spray, parts washer allows work to be charged or discharged from either side at 90° angle as well as to the front of the loading table in the normal manner. A locking device prevents table from moving accidentally. Available as single or double end design, the unit offers additional flexibility as two tables are supplied, one at the loading end and one at the discharge end of the washer.

The packaged washer is manufactured in standard sizes to match furnace sizes: 24x36x18 - 24x48x24 - 24x54x24 - 30x48x24. Other features include: spray nozzles above and below the work, minimum circulation of 240 gpm, automatic wash cycle timer which shuts off pump when washing is completed. Choice of heating: gas, steam or electric; automatic temperature control with pilot safety device and automatic liquid level control. The unit is supplied completely piped and wired so that a minimum of installation time is required to place the washer in operation.

Plastic Laminate

Kaykor Products Corp., Dept. MF, Yardville, N. J.

Kaylite represents an entirely new

type of laminate which combines the advantageous physical properties of a fiber-base laminate with the many physical as well as chemical desirable properties of rigid polyvinyl chloride.

In addition to the outstanding chemical resistance of rigid PVC, the laminate may be exposed to both higher as well as lower temperatures than are recommended for rigid PVC. This is due to the fact that the structural strength is provided by the fiber-base laminate core, which offers a dimensionally stable foundation onto which are laminated rigid PVC surfaces.

The laminate can be formed and fabricated by methods common to the sheet metal and plastic trade and can be joined to itself by chemical adhesives as well as the hot-air welding method for thermoplastic materials.

Flock Gun

Cellusuede Prods., Inc., Dept. MF, 500 N. Madison St., Rockford, Ill.

A revolutionary new flock gun to spray flock and water simultaneously eliminates the need for separate spray guns when handling flock having its own built-in adhesive. In addition, it

provides the convenience of one-hand operation. This new "Dual Aqua Jet" spray gun is designed to fit most of the flocking machines now on the market and in use.

Brass Stripper

Tivian Laboratories, Dept. MF, P.O. Box 2311, Providence, R. I.

"B-Strip" is designed for removing defective brass plating from steel at room temperature, via rapid immersion. There is absolutely no pitting or other damage to the basis metal, it is claimed. The entire immersion operation takes a maximum of 15-20 minutes.

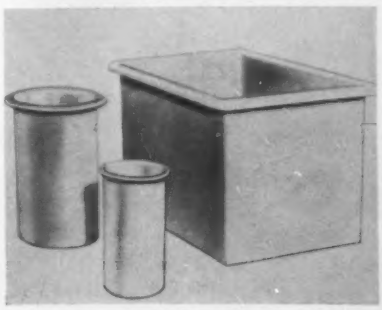
The stripper contains no cyanides, has a pH of about 9, and contains no oxidizing agents. Thus, it meets rigid government plating standards for special electronic components.

Plastic Tanks

Apex Reinforced Fibre-Glass Div., Dept. MF, Washington & Elm Sts., Cleveland 13, Ohio.

A new, low-cost line of molded polyethylene tanks, available in eleven sizes, permit safe-handling of corrosives, prevent contamination, are unbreakable, and seamless molded for extra strength and rigidity.

Rectangular shapes are available in 10, 30 and 60 gallon capacities. The cylindrical shaped tanks come in 15,



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30, 55, 100, 150, 200, 250, 350 gallon capacities.

Tanks can be fitted with valve, drain, inlet, outlet and overflow connections at extra cost. Covers are optional.

Stock sizes are available for immediate delivery. Custom-produced containers can be fabricated to customer specifications without delay

Solvent Degreaser

Currier Co., Dept. MF, 511 O'Neill Ave., Belmont, Cal.

The Vatron 120 consists of an electrically heated stainless steel open-top cleaning chamber with condensing coils, and a hinged lid that is also a water cooled condenser. The under surface of this lid condenser is covered with a multitude of drip points on which vapors can condense to give a rain-like flushing action.

Two quarts of solvent, such as Freon TF, trichlorethylene, or methylene chloride, is boiled in the cleaning chamber to create vapors which are confined within the chamber by the condensing coil, as with a conventional vapor degreaser. Vapor cleaning therefore begins immediately when a basket of parts is placed in the unit. The solvent shower lid is closed, and the water cooled multi-tip surface is positioned below the lowest condensing coil in the chamber. This unique feature causes the vapors to condense on each point of the multi-tip surface and the condensate to gently rain down on the parts below. Parts are removed warm, drying instantly as they leave the unit.

The unit is housed in a two-tone green epoxy coated insulated enclosure. A simplified control panel with pilot lights, dual heat switch and bell ring-

ing timer is provided for operation and safety controls include solenoid valve, automatic water shut-off, and hi-heat thermostat. Entire tank interior, including coil condenser, work rest and lid condenser is fabricated of stainless steel.

Bench Rectifiers

Hanson-Van Winkle-Munning Co., Dept. MF, Church Street, Matawan, N. J.

A new bench rectifier line is designed to provide maximum power in a minimum space. The rectifiers' one-piece cabinet shell comes off easily, making all internal parts easily accessable. Simplicity of design — the unit has only 5 parts — makes the new line both economical and easy to maintain, it is stated.

The ratings of the new units range from 150 amperes at 24 volts, down to 25 amperes at 6 volts. There are 3 basic cabinet sizes with a standard face size, 13″ x 15″. Depths are 10″, 15″, and 20″.

All units are equipped with large scale ammeter and voltmeter for quick meter readings. A powerstat provides vernier control of voltage from zero to rated voltage.

Portable Electric Infrared Panels

Radcor, Inc., Dept. MF, Bradner, Ohio.

New electric infrared portable heat panels can be formed into any size paint baking or curing oven design. Versatile in application and low in cost, these panels can give results equivalent to those obtained by custom-made process ovens, it is claimed. They are offered in a variety of widths

and heights with the top sections hinged for inclining in an arc to form half an oven section. By placing similar units opposite one another, an oven of any size can be formed by merely rolling them into position and inclining each bank of units as desired.

The panels can be obtained in four different reflector wattages from 125 to 500 watts, and heat sources of Chromalox Metarays or G-30 glass lamps. These heat sources have 12-inch square anodized aluminum reflectors for uniformity of radiation at distances of 10″ or more. They are mounted in die-formed pressed steel banks of 4, 6 and 8-foot widths. A toggle switch controls each reflector bank. A 20-foot supply cord and cap is furnished for connection to 240-volt, 3-phase power supply.

Primer for Zinc Surfaces

Rip-Trude Corp., Dept. MF, 110 Gateway Rd., Bensenville, Ill.

Top-Galva is a metallic solution which, when sprayed, brushed, or dipped on galvanized metal, forms a union with the zinc and deposits on the zinc a non-corrosive, non-chipping coating. This coating provides a tenacious paint adhesion surface and completely eliminates the chipping, peeling and blistering commonly found on painted galvanized metal surfaces, it is claimed.

Plastic Lining Material

Joseph T. Ryerson & Son, Inc., Dept. MF, Box 8000-A, Chicago 80, Ill.

A new flexible and elastic corrosion resistant plastic sheet material has been introduced for lining tanks, ducts and other equipment made of steel, wood or concrete. Sold under the trade name of Ry-O-Line, its advantages are described as; (1) resists corrosive at-

tack of many alkalies and acids, (2) highly resistant to abrasion and erosion, (3) polished surface facilitates solution flow, and (4) easily applied and maintained. Supplied in $\frac{3}{32}$", $\frac{1}{8}$" and $\frac{3}{16}$" thicknesses.

Tack Rags

Detro Mfg. & Sales Co., Dept. MF, Culver City, Calif.

New Detroit "tac" rags, as a result of a specially-patented chemical process developed, are now the only non-inflammable, static-free tack rags that truly prepare a surface for painting, since they prevent re-attraction of microscopic dust and dirt particles to the surface, it is claimed.

Considered an absolute necessity to all finishers using varnish, lacquers and all synthetic enamels, the tack rags save time and eliminate rejects by excluding even the faintest possibility of a blemish on a final coat of paint or finish.

Plastics-Welding Kit

Kamweld Products Co., Dept. MF, 932R Washington St., Norwood, Mass.

The Model 15-TM kit consists of a plastics-welder Model 14-HW, an aluminum welder-stand, a round welding tip, a tack-welding tip, a 16-foot neoprene air hose with an electrical three-wire cord, "practice" pieces, instruction manual and descriptive bulletin, all contained in a steel carrying case. The welder has an air-flow regulator and gage; an air-cooled handle that houses the heating-element connector with a 320-watt stainless-steel element and a barrel.

The equipment is well suited for the tack-welding, hand-welding, and medium-speed welding of many thermoplastics such as polyproplene, polyethylene, rigid and plasticized PVC, and plasticized tank linings.

The kit has over-all dimensions of 16x7x7½ inches, and weighs complete only 12 pounds.

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- No "down time" for one operator when the other changes wheel — each operator has his own motor, control and variable speed drive.
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- Wheel economy and better finish. As wheel wears each operator can increase speed — to maintain constant peripheral speed for uniform and better finish, maximum production and wheel life.
- Available in 4 sizes — two 5 HP, two 7½ HP, two 10 HP or two 15 HP.

ALSO AVAILABLE IN WIDE SWING MODEL VRROW

Wide swing construction, with extended bearing housings and spindles, provides additional working space for large, bulky pieces.

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Manufacturers' Literature

Buffing and Polishing

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

This new 20-page technical manual covers the manual or semi-automatic polishing, burring, satin finishing, buffing and high coloring of metals, plastics, wood and organic coatings on wood. Data include finish selection, finish appearance and characteristics, and the various production factors affecting different surface finishes. Also included are general application tables for various types of abrasive compositions.

Centrifugal Pumps

Industrial Filter & Pump Mfg. Co., Dept. MF, 5900 Ogden Ave., Cicero 50, Ill.

An eight-page brochure, Bulletin No. 301, on centrifugal pumps designed specifically for corrosive service, includes complete performance curves and other technical data.

Acid Gold Analysis

Sel-Rex Corp., Dept. MF, Nutley, N. J.

Quick, accurate analyses of acid gold alloy plating solutions obtained by polarographic methods are described in 3 page paper by *Dr. Karl Schumpelt* and *Arnold H. Craft.*

Finishing Products and Processes

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

A new six page brochure describes a diversified line of metal finishing processes, plating chemicals, and equipment.

The new check list introduces new product lines for steam cleaning and chemical plating. Additionally, it briefly describes many other products for finishing of aluminum, blackening and coloring, rust and scale removal, metal stripping, inhibiting of rust and tarnish, stripping of organic finishes, and metal cleaning and degreasing.

Buffing and Polishing Compounds

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

A new bulletin, Co-105, describes and illustrates a full line of both liquid and bar compounds for automatic and manual buffing and polishing operations. General recommendation charts for both bar and liquid compounds have been compiled carefully and will be helpful to compound users. Principal classifications of buffing and polishing compounds and their applications are described in detail.

In addition to describing buffing and polishing compounds for all types of metals, the bulletin discusses compounds for finishing hard rubber and plastic products.

Electrocleaner

J. B. Ford Div., Wyandotte Chemicals Corp., Dept. MF, Wyandotte, Mich.

Covered in Bulletin F-6550 is the use of Lectrite NF at varied concentrations and temperature ranges for electrocleaning brass, zinc die castings, lead-base alloys, nickel-silver, and other special alloys. Featured in the bulletin, is the use of the material in automatic plating machines where long transfer times can cause staining or etching of buffed surfaces.

Steam-Detergent Cleaning

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

A concise, up-to-date compilation of the most modern methods and materials currently used in steam-detergent cleaning is presented for quick reading in a new, illustrated booklet.

The booklet offers valuable tips on steam cleaning in general and lists the six essential properties which all effective detergents used in steam cleaning should have. It also features pictures and technical specifications of the Hurriclean steam-detergent gun and the new, lightweight Steam Pistol plus a descriptive outline of the more successful materials now used in steam-detergent cleaning.

Soak Cleaner

MacDermid Inc., Dept. MF, Waterbury 20, Conn.

Metex S-426, a new general purpose soak cleaner that removes oil, grease and buffing compound from all metals is fully described in Technical Data Sheet No. 104-1, a three-page usage and instruction sheet.

Wet Blasting Applications

Lord Chem. and Equip. Div., Wheelabrator Corp., Dept. MF, 2068 S. Queen St., York, Pa.

Bulletin No. 105 shows how and

20,000 drumfuls say you take no chances...

Cutting corners on rack coating quality subjects a bath to contamination trouble at worst...or incurs short rack coating life at best.

It doesn't pay. Thousands of gallons of plating solution are a costly investment. Operating problems from contamination take their toll in lost production. And saving a few cents per rack at the start turns out to be no saving at all if racks fail prematurely.

where savings can be made in precision finishing costs through the use of wet blasting. In addition, it describes the way "hand finishes" can be achieved mechanically at low cost in a great variety of production processes, thereby providing a guide with which to analyze finishing operations.

Electroless Nickel

Kanigen Div., General American Transportation Corp., Dept. MF, 135 So. LaSalle St., Chicago 90, Ill.

A twelve-page illustrated brochure, Technical Bulletin 561, covers such aspects of the Kanigen process, a chemically deposited nickel alloy coating, as chemical analysis, surface appearance, application, corrosion studies, and plating methods used.

Vacuum Metalizing

F. J. Stokes Corp., Dept. MF, 5500 Tabor Road, Philadelphia 20, Pa.

A new and comprehensive brochure on vacuum metalizing sets forth advantages over other metal-deposition techniques, a large number of current applications are illustrated, suggestions on lacquering and filament arrangement are given, as well as complete specifications for the latest designs of vacuum metalizing equipment. Bulletin 584.

Spray Booths

Binks Mfg. Co., Dept. MF, 3140 Carroll Ave., Chicago 12, Ill.

A new catalog describes the manufacturer's complete line of spray painting booths and related equipment. The booklet also covers air exhaust fans, chambers and systems, infra-red ovens, mixing and circulating tanks, pumps, and stand pipes.

Catalog No. SB-1 contains 36 pages with an easy to use index. It makes liberal use of photographs, sketches, diagrams and plan views to fully describe and illustrate the various pieces of equipment. Full specifications are listed on each item of equipment.

Corrosion-Resistant Materials

Atlas Mineral Products Co., Dept. MF, Mertztown, Pa.

A new 16 page bulletin describes a complete line of corrosion proof cements, flooring materials, interliners, coatings and rigid plastic fabrications.

Five pages are devoted to the six standard corrosion-proof cements based on furan, phenolic, epoxy and polyester resins and sulfur and silicate materials. Complete data on physical properties and estimating tables on tank and floor construction are given.

Tabular data on physical properties, application methods and constructions are also presented for three types of epoxy flooring material; hot-melt and sheet interliners; epoxy, vinyl and neoprene-based protective coatings and polyester and polyvinyl chloride rigid plastic fabrications.

Resistance data on 166 common corrosives for all 17 products are given in an easy-to-read four page chart.

Test Equipment

Gardner Laboratory, Inc., Dept. MF, 5521 Landy Lane, Bethesda 14, Md.

A new twenty-eight page, illustrated bulletin lists the optical as well as physicial test instruments manufactured and distributed by the above firm, with a description of each item and its cost.

when you have Coating 218X on racks

Twenty thousand drums of outstanding rack coating performance back up every user of Unichrome Coating 218X. Here is the original, heavy duty vinyl plastisol rack coating. What better proof of quality and satisfactory service than those million gallons, covering millions of racks?

The best quality is your greatest economy in the long run. Be sure to have a nearby applicator coat *your* racks with Coating 218X. Ask for names. Or do it yourself if you have baking facilities.

M&T COATINGS & FINISHES

METAL & THERMIT CORPORATION

General Offices: Rahway, N. J. • In Canada: M&T Products of Canada Ltd., Hamilton, Ont.

Inorganic Zinc Coating

Carboline Co., Dept. MF, 32 Hanley Industrial Court, St. Louis 17, Mo.

Written in clear, understandable terms, Bulletin 400 describes the galvanic principle of inorganic zinc protection, both in immersion and non-immersion service. Portions of the bulletin are devoted to a discussion of Carbo Zinc 11 with or without topcoats, as a tank lining, and as a high temperature coating. Physical properties and application advantages are included.

Roof Ventilators

Hartzell Propeller Fan Co., Dept. MF, Piqua, Ohio.

Complete details, specifications, dimensions and performance data on four types of propeller fan-powered roof ventilators are included in a new Bulletin, A-112E.

Centrifugal Abrasive Blasting

Wheelabrator Corp., Dept. MF, 1150 S. Byrkit St., Mishawaka, Ind.

A completely revised 28-page catalog, No. 162-D, describes the complete line of Super Tumblast batch-type airless abrasive blast cleaning machines. Extensive use of photographs, cross section and exploded views, and drawings is made in explaining construction features and operating sequences.

Color Card of Color Coding Enamels

Reynolds Ink, Inc., Dept. MF, 2075 E. 65th St., Cleveland 3, Ohio.

This cover card has actual chips of the 18 popular colors of new, fast drying, spray type enamels, used for color coding inventory stocks and work in process, for identifying piping, electrical connections, fire and water valves, etc., directing inter-plant routing of materials, and all other color coding operations.

Industrial Gloves

B. F. Goodrich Industrial Prod. Co., Dept. MF, Akron, Ohio.

A guide to the selection of industrial gloves for handling nearly 400 different chemicals features a new eight-page illustrated catalog.

Included in the publication is a performance chart which rates the comparative wear and chemical resistance of neoprene, neoprene-coated, Koroseal-coated and rubber gloves. Each of the 16 different kinds of BFG industrial gloves is described and illustrated.

Fans & Blowers

Super Vacuum Mfg. Co., Inc., Dept. MF, 1055 E. First St., Loveland, Col.

An all new color brochure illustrates and describes a complete line of industrial fans and blowers. Complete specifications and engineering performance chart are included, together with industrial application descriptions. A simple chart is also provided to compute the required number of units needed for a given enclosure, warehouse, plant or store.

Corrosion Resistance of Hot Galvanizing

Hot Dip Galvanizers Assn., Dept. MF, 34 Berkeley Square, London, W. 1.

This publication, the first in a new series of technical booklets to be issued by the Association, is intended to give engineers, architects and designers up to date and accurate information on the performance of hot galvanized coatings in various environments — in contact with fresh and sea water, with oils, chemicals, building materials, in agricultural conditions and underground. The advantage of using heavy coatings to obtain more complete protection against rust is stressed.

Acid-Proof Cements

Acid-Proof Cement Manufacturers Association, Dept. MF, 1015 Chestnut St., Philadelphia 7, Pa.

Resistance Charts for Acid-Proof Cements, a new bulletin to be used as a guide in selecting the proper acid-proof cement for corrosion proof installations, contains a list of more than 75 corrodent solutions and a rating for the various types of acid-proof cements at temperatures of 75°F. and 140°F.

Processing Chemicals

Nopco Chemical Co., Dept. MF, 60 Park Place, Newark 1, N. J.

This four-page bulletin lists broad general categories of products and shows the chemicals and types available in each. Also included are descriptions of chemical class and uses for each.

Categories included are surfactants, hydrosulfites and sulfoxylates, defoamers, resin and wax emulsions, water-soluble lubricants, water-soluble resins, softeners, and gas-fading inhibitors. Also listed are enzymes, metallic soaps, stabilizers, and inorganic compounds.

Centrifugal Enameler

Leon J. Barrett Co., Dept. MF, P.O. Box 378, Worcester, Mass.

A new brochure describes a recently developed, air-powered centrifugal enameler, for the application of paint, enamel and other coatings to small parts.

Chemical Equipment

Industrial Filter & Pump Mfg. Co., Dept. MF, 5900 Ogden Ave., Cicero 50, Ill.

Brochure GEN-61 describes and illustrates such items as pressure filters, ion exchangers, demineralizers, water softeners, centrifugal pumps, heat exchangers, and waste treatment systems.

Make-Up Air Systems

Metals Engineering & Mfg. Co., Inc., Dept. MF, 8824 Lyndon, Detroit 38, Mich.

A 16-page make-up air systems catalog depicts six basic types of Sun-Flo direct gas-fired make-up air units. Also shown are 9 models of burner sections and make-up air systems accessories, including shut-down damper sections, door heat seals, angle filter banks, roof hood air intakes, wall intake louvers, and louver towers.

NEW BOOKS

Elementary Science

By E. A. Ollard. Published by Robert Draper Ltd., 85 Udney Park Road, Teddington Middlesex, Eng. 1961. 99 pages, including appendix and index. Price: 18 shillings.

The reader should not be misled by the small number of pages and the relatively low price of this little volume. Written especially for electroplating students and foremen it comprises an easy-to-read text which serves to explain chemistry, electricity, electrochemistry, and calculations to the beginner.

Its purpose is to supplement the usual textbooks, not to displace them. Accordingly, it does not go into broad detail but limits itself to fundamentals. Perusal of the seven chapters will enable those without any previous study to understand the reasons behind the

operations performed in the plating department. The chapters consist of principles of chemistry, chemical analysis, electricity, and electrochemistry, properties of electrodeposits, units of heat, and plating calculations. As a preliminary to further study of the subject, this little volume is very highly recommended.

Water Treatment

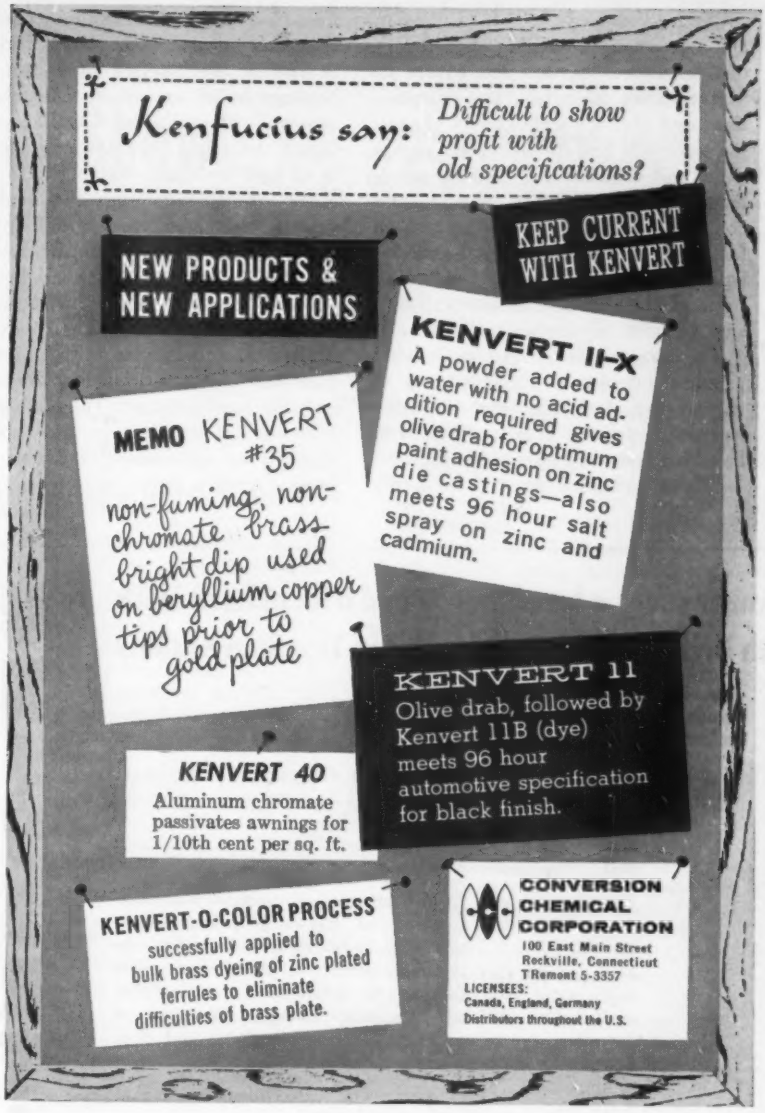
By Eskel Nordell. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 1961. 598 pages, including index. Price: $12.00.

This is the second edition of an authoritative volume on treatment of water for industrial and other uses, bringing the subject matter up to date for the 10 years since the first edition. The book is one of the most complete ever published, and of interest to all users of water in quantity, where purity is of concern, which includes metal finishing. Purification of process water by various commercial methods is detailed, as are the effects of dissolved and suspended matter usually found in private and public water supplies. For information on sampling, testing, and standardization of impurity concentration for different purposes, this book will obviate searching through the literature, since the information will probably be available from this one source.

Transactions of the Symposium on Electrode Processes

Edited by Ernest Yeager. Published by John Wiley & Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1961. 374 pages, including index. Price: $20.00.

The papers published in this book were presented at an international symposium of the Electrochemistry Division of *The Electrochemical Society* in Philadelphia two years ago. The subject matter is concerned with fundamental processes such as research developments in hydrogen discharge kinetics, electrodeposition and dissolution of metals, electrical double layer, and adsorption phenomena. Discussions which followed the presentation of each paper are included and, although this volume would be of no interest to the practical electroplater, research chemists in the field of electrodeposition will find it very informative as an indication of recent work in this and in foreign countries.


Kenfucius say: Difficult to show profit with old specifications?
KEEP CURRENT WITH KENVERT
NEW PRODUCTS & NEW APPLICATIONS
KENVERT II-X
A powder added to water with no acid addition required gives olive drab for optimum paint adhesion on zinc die castings—also meets 96 hour salt spray on zinc and cadmium.
MEMO KENVERT #35
non-fuming, non-chromate brass bright dip used on beryllium copper tips prior to gold plate
KENVERT 11
Olive drab, followed by Kenvert 11B (dye) meets 96 hour automotive specification for black finish.
KENVERT 40
Aluminum chromate passivates awnings for 1/10th cent per sq. ft.
KENVERT-O-COLOR PROCESS
successfully applied to bulk brass dyeing of zinc plated ferrules to eliminate difficulties of brass plate.
CONVERSION CHEMICAL CORPORATION
100 East Main Street
Rockville, Connecticut
TRemont 5-3357
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Canada, England, Germany
Distributors throughout the U.S.

1540 Questions and Answers for Electricians

Published by Arco Publishing Co., Inc., 480 Lexington Ave., New York 17, N. Y. 1961. 180 pages. Price: $3.00.

Although this self-testing text was prepared for job and test training and for passing electricians' licensing examinations, the considerable electrical equipment found in the plating room would indicate the desirability of the finishing supervisor having some familiarity with the subject matter. The questions and answers are grouped in neatly detailed chapters, including installation methods, motors and generators, electrical measurement, fuses, breakers and busbars, wiring and insulation, and other equipment. At this low price, the book is a worth-while refresher for the shop man.

Technology of Non-Metallic Coating

By A. Ya. Drinberg, E. S. Gurevich & A. V. Tikhomirov. Translated from the Russian and edited by E. Bishop. Published by Pergamon Press, 122 E. 55th St.; New York, N. Y. 1960. 531 pages. Price: $15.00

The original of this book was published in Russia in late 1957, and was planned as a text book for students of chemical engineering specializing in the field of non-metallic coatings. The

subjects discussed include corrosion and corrosion prevention, the theory of film formation and the nature of film forming materials, the compositions and uses of a wide variety of coating materials and the materials, equipment and methods for coating wood, metals, textiles, leather, plaster, and concrete. Special emphasis is laid on factory finishing methods, and on equipment for mass-production painting and drying. There is also a discussion of safety methods.

The information in this book is of primary interest to students, and to engineering, technical, and scientific workers. However, it is too limited to be of interest to industrial workers.

The introduction to the book defines inorganic non-metallic coatings as "either inorganic compounds formed *in situ* on the surface of metals, or coatings based on silicate enamels or cement." Organic non-metallic coatings it defines as "film formers (usually of high molecular weight)"; to this latter group of coatings the book is primarily devoted.

The volume includes much information not hitherto readily available on the methods used in the Soviet paints and finishes industry. The book is illustrated, and tabular information is presented concerning composition of enamels, emulsions, etc. The book however has not been typeset and, consequently, its appearance is not of the highest quality.

Michner saves a lot of money and a lot of hard work with UNIVERTICAL Ball Anodes in Titanium Baskets

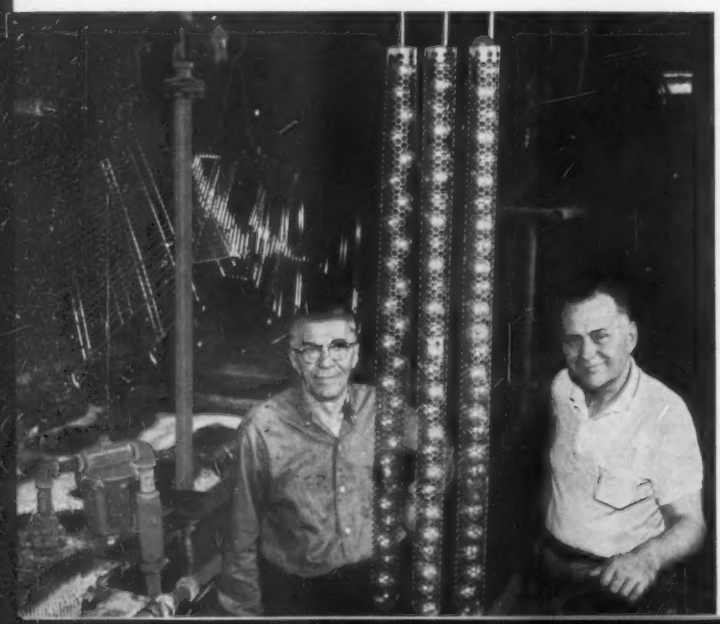
Reports JOE MICHNER,
Owner of the MICHNER PLATING COMPANY,
Jackson, Michigan

Joe Michner is a plater with 42 years of experience. He and Malcolm Smith, Plant Superintendent, inspect Univertical titanium baskets loaded with Univertical nickel ball anodes before they enter the automatic plating machine.

Titanium baskets have been used continuously for two years in plating by one of the largest automotive bumper plants. The ability to maintain constant anode area reduces greatly the possibility of plating out nickel from metal salts. There is no scrap problem, remelt or replacement. "Fringe benefits" include reduction of downtime for replacement of anodes and the fact that floating anode bags are eliminated.

Results like these are common with Univertical nickel ball anodes. Ask Univertical for full details.

UNIVERTICAL CORP. 14841 Meyers Rd., BRoadway 3-2000, Detroit 27, Michigan



UNIVERTICAL CORP.

Metals Handbook, Vol. 1

Published by American Society for Metals, Novelty, Ohio. 1961. 1300 pages, including index. Price: $30.00.

Taking full cognizance of the importance of corrosion, the new 8th Edition contains more useful and reliable information on this subject than any previous edition of this invaluable reference. Twelve major articles now deal with the corrosion of specific metals and alloys. Covering 133 pages, these articles alone contain 272 illustrations and 134 tables. Their value is further enhanced by other leading articles on mechanical properties and fabricability of corrosion-resistant metals. The entire volume is devoted to the selection and properties of metals and is the first of a projected series which ultimately will cover all branches of metals engineering and metalworking. A total of 1300 metals specialists are named as contributors.

A 24-page article on "Selection of Mild Steel for Corrosion Service" provides an unusually comprehensive treatment of a subject of major interest. Equally helpful are the articles dealing with the selection of stainless steels for atmospheric and marine corrosion service and for corrosion service in chemical processing equipment. Still other articles evaluate the corrosion characteristics of aluminum, copper and copper alloys, lead, magnesium alloys, nickel and nickel alloys, zinc, and precious metals. Several more specialized articles deal with such subjects as the selection of tin coatings for steel containers.

Extensive data compilations delineate the properties of corrosion-resistant and heat-resistant alloy castings, cast nickel-base super-strength alloys, cobalt-base alloys, and other alloys of particular interest to corrosion engineers. A greatly enlarged section on stainless steels now provides ample coverage of all stainless steels (cast and wrought), including the more recently developed precipitation-hardening alloys.

Compared to the subjects on properties and selection in the previous edition, the new handbook offers nearly six times as much numerical information (as distinguished from descriptive text) in the form of charts, graphs, and tables. A carefully planned 64-page index makes information searching easier and less time-consuming.

National Metal Show

Cobo Hall, Detroit

October 23-27

A preview of exhibits in the cleaning and finishing classification.

SHOW HOURS	
Monday, Oct. 23	10 A.M. to 6:00 P.M.
Tuesday, Oct. 24	10 A.M. to 9:30 P.M.
Wednesday, Oct. 25	10 A.M. to 9:30 P.M.
Thursday, Oct. 26	10 A.M. to 6:00 P.M.
Friday, Oct. 27	10 A.M. to 5:00 P.M.

ACME MANUFACTURING CO., 1400 East Nine Mile Rd., Detroit 20, Mich.

A new low cost Model JC abrasive belt finishing machine and a new versatile vertical polishing and buffing machine will be featured. The Acme Jodel JC abrasive belt finishing machine performs flat grinding, deburring and polishing operations on such parts as bars, strips, blanks, stampings, forgings, die castings, and sand castings.

ALLEN AIRCRAFT PRODUCTS, Ravenna, Ohio

New improved Allen-Dizor Model 500 Compact Electroplating Unit for heat treat stop-off, maintenance and salvage plating. Model 500 Electroplating unit is for experimental or short-run plating or anodizing, for applying copper stop-off plate in case-hardening, or building up worn parts with hard chromium plating.

AUTOSONICS, INC., 4217 Chestnut St., Philadelphia 4, Pa.

The new AutoSonex Feedback Solvent Control System is a contribution to industrial cleaning because it makes practical and economical the use of such solvents in production cleaning. Ultrasonics is being utilized, where needed, in a continuous production flow automated arrangement. In the Multi-Wheel model 36-6 and the Mono-Wheel model 18, with the Air Control System and ultrasonics, internal wear is virtually eliminated, simply because there are no friction points and no internal bearings; the wheels simply move within the encircling chains.

BALCRANK, INC., Disney & Marburg, Cincinnati 9, Ohio

Air & Airless Spray units will be displayed. Two airless units in operation will be spraying water base paints. There will be a display of material handling pumps of which there are 316 stainless steel models in 3 different sizes. For one gun operation Balcrank Little Giant "Hy Spray" Airless units are specially designed for spraying all water base paints as well as all other types.

BINKS MANUFACTURING COMPANY, 3140 Carroll Ave., Chicago 20, Ill.

The new Binks Dispo spray booth and the latest in airless spray finishing equipment will be shown. In addition, items of the regular industrial finishing line including spray guns, material handling pumps, stand pipes, automatic finishing machines controlled by Binks memory timers, and air supply fans.

G. S. BLAKESLEE & CO., 1844 South Laramie Ave., Chicago 50, Ill.

Degreasing equipment.

BRANSON INSTRUMENTS, INC., 37 Brown House Rd., Stamford, Conn.

Ultrasonic cleaning equipment.

DELTA MANUFACTURING CO., 1137 West Hilton, Phoenix, Ariz.

Barrel finishing equipment.

DESPATCH OVEN CO., 619 South East 8th St., Minneapolis 14, Minn.

Baking ovens.

DOW CHEMICAL CO., Abbot Rd. Bldg., Midland, Michigan

Chlorothene NU, a solvent combining safety and economy, will be featured by the Dow Chemical Company at the A.S.M. Detroit Metal Show. Dow claims the solvent is one of the least toxic and least expensive of all common chlorinated solvents. Other Dow solvents which will be included in the display are trichloroethylene, perchloroethylene, and methylene chloride.

DRY CLIME LAMP CORP., 410 Mill St., Greensburg, Ind.

Infra-red baking lamps.

VIBRODYNE DIVISION, GLOBE INDUSTRIES, INC., 125 Sunrise Place, Dayton 7, Ohio

Vibratory finishing machines of 6 cubic foot capacity and smaller units will be shown.

GRAY COMPANY, INC., 60 Eleventh Ave., N.E., Minneapolis 13, Minn.

Paint handling equipment.

HEIL PROCESS EQUIPMENT CORP., 12901 Elmwood Ave., Cleveland 11, O.

On exhibit will be the following items, some of which will appear for the first time:

1. New series 700 fume washers for chrome acids and other fumes.
2. New high speed chromium plating round anodes.
3. Solid Rigidon (fiberglass reinforced resin bonded) molded plastic dip tanks. Also appearing will be an improved medium pressure line of Rigidon solid plastic centrifugal fans and recently improved Rigiline 413 and Rigiflor 2413.

E. F. HOUGHTON & CO., 303 West Lehigh Ave., Philadelphia 33, Pa.

The exhibit at the Metal Show features a product-in-use demonstration of a new solvent paint stripping compound. The compound, Houghto-Clean 224, will swell epoxy paint on steel and aluminum panels in 30 seconds so water washes it away. Houghto-Clean 224 will be compared to hot caustic, which has little effect on epoxy paint and actually destroys aluminum.

R. O. HULL & CO., INC., 1260 Marion Ct., Rocky River 16, Ohio

Plating processes and supplies.

KOLENE CORPORATION, 12890 Westwood, Detroit, Mich.

Tufftride — the new metal treating process will be featured by the Kolene Corporation. This molten-salt bath process is applied to mild, stainless, alloy steels and cast iron to produce tough, wear resistant surfaces as well as increasing the fatigue strength of the material. In conjunction with the Tufftride process an X-ray diffraction unit will be employed as a non-destructive quality control medium.

In addition Kolene will have visual display facilities for showing and discussing their new molten jet-spray process for descaling stainless steel and the #4 and #5 Kolene processes.

MANPRO CORP., 1360 Hilton Rd., Ferndale 20, Mich.

Degreasing equipment.

New Cobo Hall

MERIT PRODUCTS, INC., 3691 Lenawee Ave., Los Angeles 16, Calif.

Merit Products Company of Los Angeles will introduce a new device in the abrasive field for deburring, finishing, smoothing, and polishing at the Show.

The company has also refurbished its exhibit to include a demonstration of their Grind-O-Flex and Sand-O-Flex wheels in actual operation to show methods of abrasive operation on stainless steel and "exotic" metals.

MERRILL BROTHERS, 56-02 Arnold Ave., Maspeth 78, N. Y.

Release-A-Matic (All Purpose) Hook is a new concept in hook design, a completely safe hook that can be released while loaded. This releasing feature permits operator to stand clear and eliminates hazards of unhooking live loads. Release-A-Matic hook design incorporates additional distinct advantages — it will fit practically any type of fitting — is light in weight while combining a wide opening with small girth, with a remarkable weight/strength ratio.

METALWASH MACHINERY CORP., 901 North Ave., Elizabeth 4, N. J.

The Rotary Drum Degreaser Metalwash model #DD is a completely new small-parts degreaser designed for non-stop work in any automated production line without need for an operator or for load-unload delays. Its three-way action, combining solvent immersion, vapor-phase, and continuous tumbling, thoroughly degreases all varieties of small parts, including cup shapes. Its new, exclusive cooling system is on the drum itself.

MIDLAND-ROSS CORP., 2375 Dorr St., Toledo 1, Ohio

The Surface Combustion and Ross-Waldron Divisions will exhibit a 22-foot long scaled model simulating a 400-foot line in which strip metal can be annealed and coated in one single continuous operation. The annealing portion of the line is built by Surface and the coating operation is designed and constructed by Ross-Waldron.

MINNESOTA MINING & MANUFACTURING CO., 900 Bush Ave., St. Paul 6, Minn.

New pressure-sensitive tapes and taping machines will be demonstrated. Special electroplating and metal bonding tapes, as well as tapes for masking, printing and nameplate purposes will be shown. Also displayed will be a new 3M industrial face mask, pipe dope, and automatic and semi-automatic tape dispensing equipment.

MURRAY-WAY CORP., P.O. Box 180, Maple Rd. E., Birmingham, Mich.

Automatic polishing equipment.

NORDSON CORP., Jackson St., Amherst, O.

Electrostatic painting equipment.

OAKITE PRODUCTS, INC., 19 Rector St., New York, N. Y.

Products to improve cleaning and surface treatments of metal will be demonstrated. The booth will feature electro-cleaning compounds; rinsing aids; paint stripping materials; compounds for cleaning, etching, and deoxidizing aluminum; barrel finishing, and deburring compounds; and conversion coatings for steel and aluminum.

PANGBORN CORP., Pangborn Blvd., Hagerstown, Md.

The latest precision finishing machine, a fully automatic, continuous process vibratory gyrator will be exhibited. The new equipment — now available in a range of sizes — will offer a solution for low cost, high volume cleaning, descaling, deburring, radiusing, fine finishing coloring, or burnishing.

Work may be fed or conveyed automatically into and out of these machines. Media are automatically cleaned, screened, and recirculated. Compound and water are also added automatically.

PARK CHEMICAL CO., 8074 Military Ave., Detroit 4, Mich.

Liquid buffing compounds, cleaners, and blackening salts.

PHILLIPS MANUFACTURING CO., 3475 W. Touhy Ave., Chicago 45, Ill.

Degreasing Equipment.

RANSBURG ELECTRO - COATING CORP., P.O. Box 23122, Indianapolis 23, Ind.

Electrostatic painting equipment.

ROTO-FINISH / RANSOHOFF, North Fifth St. at Ford Blvd., Hamilton, O.

The automatic Vibration Burnishing System, Model ARV 40, for continuous production or batch-type production.

SOUTHWESTERN ENGINEERING CO., 4800 Santa Fe Ave., Los Angeles 58, Calif.

High-efficiency deburring and polishing of metal, plastic, and ceramic parts by means of three-dimensional, high-frequency, low-amplitude vibration utilizing Vibro-Energy Finishing Mills. There is a spiral orbital movement of the parts through the media and compound, as well as the vibrating and sliding action associated with barrel finishing. Design simplicity permits lower horsepower motors and minimum maintenance.

TURCO PRODUCTS, INC., 24600 South Main St., Wilmington, Calif.

Metal cleaning materials.

UNIVERTICAL CORP., 14841 Meyers Rd., Detroit 27, Mich.

Nickel ball anodes in titanium anode baskets will be displayed as well as Phosphor-Brite Copper anodes and OFCP (Oxygen free chemically pure copper anodes).

VAPOR BLAST MANUFACTURING CO., 302 W. Atkinson St., Milwaukee 9, Wis.

Vapor Blast machine is a production machine with a constantly rotating, vertical turntable having a variable speed and fitted with magnetic holding fixtures. Fixed Vapor Blasting guns inside the machine are directed at specific areas on parts to be blasted, and additional guns are oscillated across the width of the turntable fixture. The guns are positively fed by an abrasive-slurry recirculating pump, and an exhaust system with automatic filter-wash is incorporated in the machine. Production varies with part size.

BUSINESS ITEMS

Top Management Changes at Metal & Thermit

Major top management changes have been announced by *Metal & Thermit Corp. H. E. Martin* has become chairman and chief executive officer. Replacing him as president is *Charles J. Beasley*, formerly vice-president and secretary of the corporation. *H. W. Buchanan*, previously a vice-president, has been named executive vice-president.

By moving Mr. Martin into the previously vacant post of chairman, the way has been cleared to promote other executives of proven ability into positions of still greater responsibility.

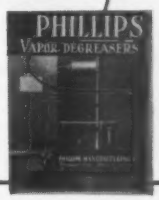
Mr. Martin has been president of the company since 1954. Prior to this time, he was with the Babcock & Wilcox Co. A licensed professional engineer in the State of New York, he majored in Chemical Engineering at Polytechnic Institute of Brooklyn. He is a Fellow of the American Society of Mechanical Engineers, a member of the American Institute of Chemical Engineers, a director of the Manufacturing Chemists' Association and a trustee of the United Engineering Trustees.

Mr. Martin also is president and a director of M&T Products of Canada Ltd., International Titanium Corporation and M&T Chemicals, AG, Zug, Switzerland. He is a director of Chromium Corporation of America.

Mr. Beasley has been associated with

Phillips

the quality name in cleaning and degreasing equipment



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Northwest Appoints Noyce

J. W. Noyce has been appointed by *Northwest Chemical Co.*, Detroit, to serve accounts in the Chicago area. He will work in cooperation with the present staff there.

Noyce is a graduate of Northwestern University and Illinois Institute of Technology.

H-VW-M Appoints Morris and Walling

Donald H. Morris has been appointed Chicago district manager by *Hanson-Van Winkle-Munning Co.* He takes the place of *Ralph R. Granquist* who recently retired.

Mr. Morris joined the company in 1955 as a field electrochemist. After spending a month's training period in the home office laboratories, he moved to the Chicago district. He is a 1941 graduate of Colgate University, and holds an A.B. in Chemistry. Upon graduation he worked as a chemical engineer for a large New York manufacturer. In 1943 he entered the Marine corps and served until the end of the War in the Pacific Theater.

Prior to joining H-VW-M, Mr. Morris worked as a process engineer for a large automotive parts processing company. He is an active member of the Chicago branch of the A.E.S. In his new assignment, he is in charge of company sales in 17 states.

William T. Walling, formerly a field electrochemist in the Chicago area, has rejoined the company in the same capacity and in the same territory. He replaces Mr. Morris.

the firm since 1949, serving as assistant controller, controller, and vice-president and secretary. He came to the company from Lybrand, Ross Brothers and Montgomery, where he was senior auditor.

Mr. Beasley was graduated Cum Laude from the College of Commerce, Notre Dame University. He served with the U. S. Marine Corps during World War II, and retired in 1959 with the rank of Colonel, U.S.M.C.R. He is a director of M&T Products of Canada Ltd., Chromium Corporation of America, and an officer of International Titanium Corp.

Mr. Buchanan joined the corporation in 1947 as a chemical engineer. Since then, he has served as sales manager for chemicals, metals and plating products. He was appointed vice-president and manager of the Chemical Division in 1960.

He received the B.S. degree in Chemical Engineering from Rensselaer Polytechnic Institute, and the M.S. degree in Industrial Management from Massachusetts Instiute of Technology where he was a Sloan Fellow. He is a member of the Society of the Plastics Industry, Society of Plastics Engineers, American Electroplaters Society, American Chemical Society and is chairman of the House Committee and a trustee of the Chemists Club.

Donald H. Morris

William T. Walling

Mr. Walling first joined the firm in 1952 as a junior chemist in the Matawan laboratories. In 1954 he transferred to Chicago as a field electrochemist. Three years later he transferred to the Grand Rapids office. He resigned early in 1960 to join a large automotive parts plater in the midwest.

Mr. Walling is a Seton Hall graduate with a degree in chemistry. He is an active member of the A.E.S.

DuBois Chemicals, Inc. Forms New Division

DuBois Chemicals, Inc. has formed an Air-Space Division for the research, development, manufacture, marketing and servicing of specialized cleaning, processing and maintenance products for use by military and commercial aircraft, missile and space agencies and industries.

Our decision to form a separate DuBois division devoted to the ever-increasing Air-Space market was based on our firm belief that this is, and will continue to be, one of the largest growth industries in the country, stated Mr. DuBois who will assume directorship of the Air-Space Division.

In addition to *Chas. A. DuBois*, who will assume directorship, the following have been selected to direct the activities of the division:

Dr. Edward B. Tooper, director of research; *Thomas C. Fisher*, associate director; *Neil E. DeBranch*, associate director; *Victor Ledbetter*, assistant director; *William P. Wilson*, research chemist; *John Keating*, research chemist; *Walter E. Wilgan*, technical representative; and *Louis R. Karraker*, coordinator.

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It offers you these advantages:

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Clinton Supply Moves

Clinton Supply Co. has moved to new and larger offices at 1025 West Jackson Blvd., Chicago 7, Ill. Their telephone number is MOnroe 6-7131. They are manufacturers of plating equipment, rectifiers, and plating supplies.

Hubbard-Hall Opens Huntington, W. Va. Plant

A new nickel anode processing plant, the only facility of its type in the southern area, has been opened by *Hubbard-Hall Chem. Co.* in Huntington, W. Va. Full scale operations, including cutting, drilling and tapping of rolled carbon nickel anodes are now in progress, with shipments being made throughout the South and Midwest. Both oval and flat anodes will be available.

The plant is in a position to give immediate delivery on incoming orders. All inquiries concerning the Huntington operation should be forwarded to the firm's general offices at Waterbury, Conn.

Flood and Conklin Appoint Nivelt

Flood and Conklin have appointed *Lawrence B. Nivelt* as their sales representative in New York. He brings with him 14 years experience in the industrial finishes industry.

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Clark-Cooper Div. of Frederic B. Stevens Inc., Appoints Representatives

The Clark-Cooper Division of *Frederic B. Stevens, Inc.*, Palmyra, N. J., announces the appointment of three new representatives.

Reed Harr Associates, 3517 Hennepin Ave., Minneapolis, is the new representative in the State of Minnesota. This company has specialized in flow control problems for many years.

William B. McNew & Associates, flow equipment engineers since 1952, will now handle the line in Northern California. They are located at 275 Brannan St., San Francisco 7.

The Bogart-Bullock Corp., 6010 S. Normandie Ave., Los Angeles 44, which has been handling flow engineering problems since 1951, will now be the representative in Southern California, Nevada and Arizona.

Branson Appoints Distributor

O'Donohue Industries, Milwaukee, Wis., distributors of industrial finishing chemicals and equipment have been appointed exclusive distributors for *Branson Instruments Co.*, Stamford, Conn., manufacturers of ultrasonic cleaning and testing equipment. For the past fifteen years O'Donohue has been distributor for Circo Corp. of Clark, N. J., who were recently acquired by Branson.

Enthone Expands Sales Force

A. John Cornish, Jr. and *James L. Dickens* have been appointed sales engineers as part of the expansion of the sales force of *Enthone, Inc.*, New Haven, Conn. Mr. Cornish will represent the firm in the Eastern Pennsylvania, Maryland and Delaware area and Mr. Dickens will handle the Buffalo, N. Y. district.

James L. Dickens

A. John Cornish, Jr.

Mr. Cornish is a graduate of Lehigh University. Most recently he has been employed as plant manager of Quality Plating Co. of Chicago. Additionally, he spent many years supervising plating installations for Westinghouse. He is a member of the A.E.S.

Mr. Dickens attended Cornell University and, for the past 1½ years, he has been a technical service engineer in the company's laboratory. Previously, he was employed by Allied Chem. Corp., Solvay Process Div., Syracuse, N. Y.

Polymer Corp. Opens New Research Laboratory

A newly remodeled laboratory designed for plastic product research and pilot plant development has been placed in operation by *Polymer Corp.*, Reading, Penna. The 14,450 square foot structure, which triples the space allotted to the firm's research, is located at 501 Crescent Ave. in the Northmont area of Reading, adjoining the company's main manufacturing plant. The research laboratory activities are under the direction of *L. Philip Muller*, director.

Oakite Appoints Jones to Headquarters Staff

Robert P. Jones, New England division manager of *Oakite Products, Inc.*, since 1954, has been assigned to the New York headquarters of the firm, which manufactures industrial cleaning and metal treating compounds. Mr. Jones, whose experience includes purchasing and accounting as well as

Robert P. Jones

sales, will do staff work for the firm, reporting directly to the president, *John A. Carter*.

Mr. Jones joined the firm in 1949 as a technical service representative in Indianapolis. He is succeeded in his New England post by *Roger R. Heroux*, formerly the company's representative in Springfield, Mass.

Diamond Alkali Co. Completes New Facilities

A new chloromethane unit has been completed at *Diamond Alkali Co.'s* Belle, W. Va., plant and is now in commercial operation. Products will include methyl chloride, methylene chloride, chloroform and muriatic acid.

The new production facilities employ the most modern scientific techniques, assuring a high degree of automation as well as low manufacturing costs. Products of an exceptionally high quality have been produced as a result of the process, developed by the company.

In addition to the new production facilities, modern office buildings and locker rooms have also been completed at the Belle installation.

Union Carbide Plastics Appoints Assistant Regional Sales Manager

Richard L. Garrison has been appointed assistant regional manager in the North Central Sales Region of *Union Carbide Plastics Co.* He will be located in the Detroit district sales office in 10421 W. Seven Mile Rd., Detroit 21, Mich.

Mr. Garrison was graduated from Trinity College with a Bachelor of Arts degree, and from Harvard University where he earned a Master of Business Administration degree in 1953. He served as an Air Intelligence Officer with the United States Naval Air Corps for three years. In November, 1956 he joined the company and, after completing an extensive sales training program at the company's research and development center, served as a technical sales representative in the Mid-Western sales region.

Stokes Establishes New West Coast Facility

F. J. Stokes Corp., Philadelphia, has opened a new West Coast facility, at 3761 E. Colorado Blvd., Pasadena, Cal. *F. Theodor Hahn* has been appointed district manager in charge of the new West Coast facility, with *Albert V. Bicknell* as sales engineer for the equipment made by the Press Division, *James A. Fox* as sales engineer for the company's Vacuum Equipment Division, and *John A. Kershaw* as district service engineer.

The new facility will serve customers and prospects in California, Arizona, Nevada, Utah, Wyoming, Idaho, and Montana, and will also provide a back-up to *Walsh Associates*, Seattle, representatives in Washington, Oregon, and Alaska.

Kelite Appoints Racine

Robert J. Racine has been appointed national sales manager of *Kelite Corp.*, manufacturers of industrial cleaning compositions, metal processing chemicals, and steam cleaning equipment.

Mr. Racine is a chemical engineering graduate of Michigan College of Mining and Technology. He came to the firm as western regional sales manager in 1956. In his new position, he will be in overall charge of sales activities in the United States.

Robert J. Racine

International Firms to Collaborate on Electrodes

Four international firms have announced completion of agreements for the production, sale and continued development of platinized titanium electrodes for use in electrochemical processes.

Engelhard Industries, Inc. of Newark, N. J., world-wide precious metals firm, has been named the licensee under United States, Canadian and Mexican patents for the manufacture and sale of the platinized titanium electrodes. This was done under an agreement between Imperial Chemical Industries, Ltd. of England, the Amalgamated Curacao Patent Co. of Curacao and Magneto-Chemie N.V. of Schiedam, Holland, who will cross-license under their patents and collaborate on developing additional uses of the electrodes.

New Custom Applicator in Michigan for Sprayable Plastisols

Installation of complete custom facilities for the spray application of plastisol coatings to a wide variety of large industrial tanks and equipment has been announced by the *G-N Equipment Co.*, 764 Wealthy, S.W., Grand Rapids, Mich.

Long experienced in the application of plastic coatings to equipment for the plating industry, the company has now expanded its operations to serve other industries as well. The installation of a new oven, measuring 40 ft. by 10 ft. by 12 ft., makes it possible for the firm to handle large industrial units, such as tanks, fume ducts and other equipment that must be protected against corrosive liquids or fumes with a firmly-bonded, seamless coating.

The plant is also equipped to provide fabrication and sandblasting service, as well as coating.

Dynasonics New Name for Narda Ultrasonics

Narda Ultrasonics Corp. has changed its name to *Dynasonics Corp.* as part of a major change in management's policies towards research and product diversification in the field of electroacoustics.

M&T Names Hopkins Plating Product Manager

The appointment of *William A. Hopkins* as product manager, Plating Division, *Metal & Thermit Corp.* was announced recently. He succeeds *Henry Mahlstedt*, who will remain with the firm in an advisory post.

Mr. Hopkins, who will continue to operate from the Detroit offices, most recently has been assigned special responsibilities for the company's line of anodes and chemicals for nickel-chromium plating.

William A. Hopkins

Prior to joining M&T at the beginning of this year, Mr. Hopkins was general manager of the Sharonville Division Plant of Electro Auto-Lite Co. near Cincinnati. From 1952 through 1957, he was vice-president in charge of sales for Bart Mfg. Co., Belleville, N. J. Prior to this, he was Michigan district sales manager for McGean Chem. Co.

A native Ohioan, he studied metallurgical engineering at the University of Cincinnati. He is a member of the A.E.S.

Dickinson Joins J. O. Ross Staff

Warren A. Dickinson, Jr. has joined the sales engineering staff of J. O. Ross Engineering Div., *Midland-Ross Corp.*

Dickinson, formerly with Procter and Schwartz Co., will handle special drying accounts from the Mt. Prospect, Illinois office. He has had a wide background of experience in chemicals, textiles, veneer, and metal finishing.

Warren A. Dickinson, Jr.

Levison Appointed Technical Director for Fidelity Chemical

The appointment of *Bertram M. Levison* as technical director of *Fidelity Chemical Products Corp.* was announced recently.

Mr. Levison, who joined the firm 14

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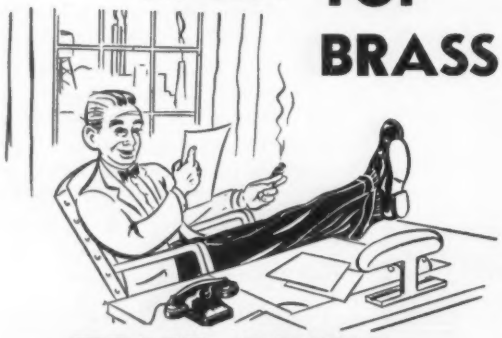

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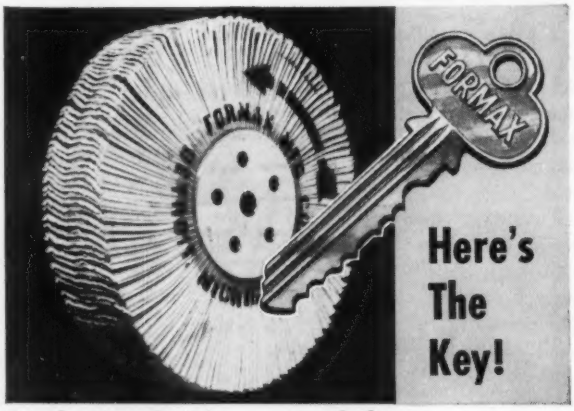

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Bertram M. Levison

years ago as a staff chemist, will be responsible for the development of new products and will direct the company's research program in the field of electronic chemicals.

A graduate of Newark State Teachers College, Mr. Levison also did advanced work in chemistry at Newark College of Engineering, Seton Hall University and New York University. He is a member of the American Chemical Society and the American Society for Metals.

Mr. Levison, a resident of Metuchen, N. J., served with the U. S. Navy as a radar instructor and as a civilian instructor for the Army Air Corps, teaching radio circuitry.

Eikenberg Elected President of Revere Copper and Brass

John H. Eikenberg has been elected president of *Revere Copper and Brass Inc.*, and a member of its executive committee, to succeed *Charles A. Macfie* who retired recently under the company's retirement plan. Election of *William T. Bertier* as a vice president and general manufacturing manager and of *Fritz C. Hyde, Jr.* as a member of the board of directors was also announced.

Mr. Eikenberg, 51, who has been a vice-president of the firm since 1945, joined the company as a clerk in the Baltimore Division in 1924. He became assistant mill superintendent in 1935, an industrial engineer in 1936, and in 1941 was appointed general industrial engineer for the company, with headquarters in Rome, N. Y. He was named director of industrial relations in 1943 and elected vice-president in charge of industrial relations in 1945. In 1957 he was promoted to assistant general manufacturing manager with headquarters in New York and became general manufacturing manager in 1958. He has been a member of the

John H. Eikenberg

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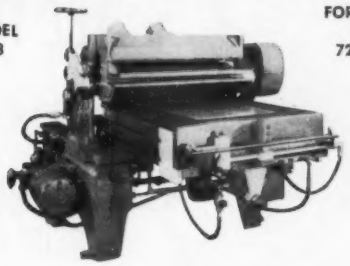

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company's board of directors since February, 1961.

Mr. Bertier has been chief engineer since 1953 and, in 1957, was also appointed assistant general manufacturing manager. He joined the firm in 1929 as mechanical superintendent in the Baltimore Division and, in 1949, became chief engineer of that division.

Mr. Hyde, assistant general sales manager, was elected a vice-president in February, 1961. He joined the company as a salesman in 1935 and was appointed assistant general sales manager in February, 1959.

Agent Appointed by Union Carbide

Quentin Nelson & Co. of Houston, Texas, has been appointed sales agent for *Union Carbide Plastics Co.*, and will service the protective and decorative paint industry in the State of Texas.

Mr. Nelson is well-known to the paint industry in the Southwest, having been engaged in the technical sales of raw materials to this field for more than thirteen years. The company has

Quentin Nelson

offices at 10223 Raritan St., Houston 43, Texas.

DuBois Chemicals of Canada Ltd. Now in New Quarters

DuBois Chemicals of Canada Ltd. has moved its general offices and complete manufacturing facilities to its new plant on Kenhar Drive and Weston Road in Weston (Toronto), Ontario.

In construction since last fall, the new 28,000 square foot facility has ample space for future expansion and the addition of more equipment. Included in the present facility are a dispenser shop, complete control and service laboratories, administrative and general offices, and modern maintenance and personnel facilities.

Sales Vice-President Appointed by Bart

Bart Mfg. Corp., announces the appointment of *Kenneth Rau* as vice-president of Lectro-Clad sales. He will be responsible for the sales and production of all heavy nickel plating.

Having attended Fairleigh Dickinson University, Rutherford, N. J., Mr. Rau resides in Verona, N. J.

Consolidated Vacuum Starts Expansion Program

Consolidated Vacuum Corp., Rochester, N. Y., subsidiary of CEC/Bell and Howell, has announced a half-million dollar expansion program. Immediate plans call for the addition of 23,000

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sq. ft. for manufacturing and research, additional parking space, and the addition of a new road. Construction is expected to start early this fall and will be completed, and in full operation, by April 1962.

Glidden Changes Name of Paint Division

The name of the *Glidden Company's* Paint Division has been changed to the Coatings and Resins Division, it was announced recently. It was stated that the new name reflects the accelerating changes taking place in the paint industry and more accurately describes the wide range of products the division offers.

Grube to Head New Section at Metals & Controls

Metals & Controls Inc., a corporate division of Texas Instruments Inc., announces the appointment of *Clifford J. Grube*, formerly Eastern regional field sales manager, to head its newly organized Jewelry Products Section.

Grube joined the company in 1944 as a sales engineer and was subsequently named New York district manager for gold filled and related products. He was named Eastern regional field sales manager in 1959. Previously, he was a sales engineer with Mercoid Corp., Chicago, and an application engineer for General Electric Co., Harrison, N. J.

Clifford J. Grube

He is a past president of the Metropolitan New York Jewelers' Assn. and a member of the American Sales Management Assn.

Baudreau Heads up Shipley West Coast Sales

Shipley Co., Inc. has announced that *James L. Baudreau* has been promoted to take charge of the company's west coast technical sales. He was previously a sales representative and helped to establish the firm's west coast headquarters in Los Angeles last February.

Mr. Baudreau previously was with MIT Lincoln Laboratory in Massachusetts as a research assistant in encapsulation of electronic components, and with the Dewey and Almy Chem. Co.

Doerringer Elected Director of U. S. Metal Coatings Co.

Russell C. Doerringer of Scotch Plains, N. J. has recently been elected a director of *U. S. Metal Coatings Co.*, Middlesex, N. J., specialists in electroplating of rolls and heavy machinery parts.

Mr. Doerringer, long active in civic and community affairs in Plainfield

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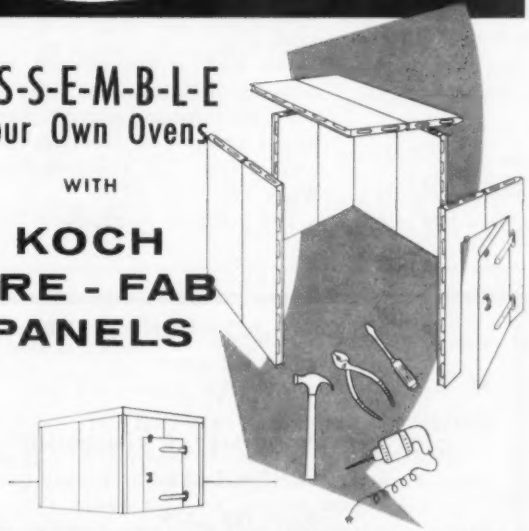

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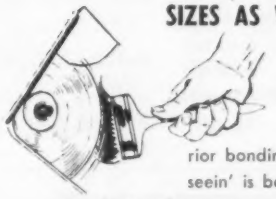

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and Scotch Plains, is retiring as vice-president of the Plainfield Trust State National Bank.

Industrial Hard Chrome Plating Appoints Lang and Babcock

James T. Lang has been appointed general manager of *Industrial Hard Chrome Plating Corp., Industrial Kanigen Corp.*, and *Industrial Hard Chrome Plating Co.*, of California. Also announced at the same time was the appointment of *John W. Babcock* as general sales manager.

Two of the plants are specialists in hard chrome plating with grinding and honing facilities. The third plant operates under a license from G. A. T. X. for deposition of electroless nickel.

Prior to joining the staff of Industrial Hard Chrome, Lang was associated with the Richfield Oil Corp. He was graduated from the University of California, Berkeley, with a B.S. degree, in the class of 1940.

Babcock is a graduate of the University of California at Berkeley. He served in the Navy during World War II and during the Korean War he was Commander, USNR. Babcock joined Industrial in 1953 as plant superintendent. In 1958 he was made manager of the Hollis Street job shop.

Wiegand Names Fleming Executive V.-P.

Appointment of *Bruce A. Fleming*, vice-president in charge of sales, *Edwin L. Wiegand Co.*, to executive vice-president, was announced recently. He joined the company in 1940 as assistant to the president. He rose to the position of vice-president and director in 1943 and has held that position up to the present time. During his career, he has become well known in the electric heating and appliance industries. Prior to 1940 he spent approximately 15 years in the appliance field.

Bruce A. Fleming

Chemetron Forms Chemical Specialties Unit

Establishment of a chemical specialties department, built around existing product lines for the metalworking and marine industries, has been announced by the Chemical Products Division of *Chemetron Corp.* Nucleus of the new department is the variety of metalworking compounds produced by the *Northwest Chem. Co.*, a subsidiary in Detroit, and the Dunham line of marine combustion catalysts and detergents.

Harold J. McCracken, Northwest Chemical president, has been named general manager of the new department.

Schlissel Joins Levco

Levco Metal Finishers, Inc. announces that *Fred Schlissel* has joined the company as general manager of its nameplate division, Aluminum Nameplate Corp.

Mr. Schlissel was formerly plant manager of Penn Akron Corp., manufacturers of kitchen cabinet hardware. He is also president of Assistance for Industrial Development, a management consulting organization specializing in the growth problems of small businesses. He is an instructor of Industrial Engineering subjects at the City College of New York.

Mr. Schlissel has a BBA Degree from the City College and a M.S. from Columbia University. He is currently a PhD candidate of New York University. He is the author of articles of management interest, management publications and has been a speaker on the subject of small business management before several trade and educational organizations.

Union Carbide's Research Institute Moves to New Laboratory

The consolidation of *Union Carbide Corp.'s* Research Institute staff took place recently with the occupancy of a new laboratory building in Eastview, N. Y. The building is located on the corporation's 280-acre site near Tarrytown, N. Y. It is the second major laboratory to be built on the site. The other, a three-story building, is the technical service laboratory which is operated by Union Carbide Chemicals Co. and was completed in November, 1959.

The staff of the institute will be made up of 60 scientists. Prior to this move, the institute's activities were dispersed among four laboratories. Laboratory space had also been leased in White Plains, N. Y.

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houses a total of 60 laboratory modules which incorporate the latest in design developed through extensive experience in research. In addition to offices for the staff, other facilities include a large technical library and machine and instrument shops.

Protective Plastic Co. Purchased by Eberley Dynamics, Inc.

Eberly Dynamics, Inc. announces the purchase of *Protective Plastic Co.*, 5116 Richmond Road, Bedford, Ohio, which will continue to manufacture fiberglass reinforced plastic ducts, stacks, hoods, and tanks.

Distribution will be on a national basis with sales representation to be established in every major industrial area.

Industrial Metal Protectives Appoints Rep.

The appointment of *Cook Paint and Varnish Co.* as exclusive sales and service representatives for Zincilate galvanic protective coatings has just been announced by *Industrial Metal Protectives, Inc.*, Dayton, Ohio.

Cook will service an area extending from Canada to the Gulf of Mexico, embracing a 14-state area from North Dakota and Michigan to Texas and Louisiana. Headquarters for this new sales and service operation will be located at the firm's main offices and plant at North Kansas City, Mo. Branches at Houston and Detroit will also serve to direct regional activities.

Cemco Inc., Establishes New York Headquarters

Cemco, Inc., announces the establishment of company headquarters at 50 East 41st St., New York 17, N. Y. Telephone: 212-MUrray Hill 3-8950.

Howard T. Von Oehsen

Howard T. Von Oehsen, president, was formerly associated with General Mills and Heyden Newport Chem. Corp. in executive capacities. He is a member of the American Chemical Society and The Chemists' Club.

Dry Clime Lamp Appoints Goodman and Tower

The appointment of *Jack L. Goodman* as assistant sales manager has just been announced by the *Dry Clime Lamp Corp.*, Greensburg, Ind. Mr. Goodman has had extensive experience in the field of radiant heating as it is applied to industry, and will be working exclusively with the driQuik Division.

The appointment of *Norman Tower*, president of *Midwest Finishing Systems*, Greensburg, Ind., as factory representative for the Indiana territory, was also announced. He was formerly assistant sales manager of Dry Clime, and has had several years of experience in industrial finishing and radiant heating.

Farrington Acquires Sanford Aluminum Hardcoating Process

The assets and business of *Sanford Process Co., Inc.*, Los Angeles, Calif., developer of a method for hardcoating aluminum alloys, have been acquired by *Electralab Printed Electronics Corp.*, a subsidiary of *Farrington Mfg. Co.* The acquisition, a stock transaction, was arranged through Sanford's parent company, *Far Best Corp.* of Los Angeles.

It was announced that Sanford Process Divisions, undertaking research and licensing activities, will be set up in the Los Angeles area and at EPEC's headquarters in Needham Heights, Mass. *John B. Franklin*, Sanford vice-president, will become an EPEC vice-president and will be actively engaged in operations of the two divisions.

Industrial Finishes in New Location

Industrial Finishes Co., Inc., whose executive and sales offices and technical service department have been located in the Land Title Building, Philadelphia, for the past six years, has moved to #2 Bryn Mawr Ave., Bryn Mawr, Pa.

The new offices have been especially designed for the company's needs in a new office building, which is located directly across the street from one of the Main Line stations of the Pennsylvania Railroad. Factory facilities will remain in Philadelphia.

Alpha Names New England Representative

Donald A. FitzGerald has been ap-

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Donald A. FitzGerald

pointed technical representative for *Alpha Metals, Inc.* He will represent the firm in the New England states of Massachusetts, Vermont, New Hampshire, Rhode Island and Connecticut, and can be reached at 12 Greenfield Lane, Scituate, Mass.

Herdlein President of New Firm

Four Detroit and Chicago industrial experts, nationally prominent in the metal cleaning, paint finishing and plant air movement fields, are investing a total of 87 years of varied industrial experiences in a newly-incorporated firm, *Wallace Herdlein & Associates Inc.*, with headquarters at 208 S. LaSalle, Chicago, Ill. Principles of the firm are all former executives of The R. C. Mahon Co. of Detroit. The new organization they direct is specializing in designing, engineering and manufacturing of metal cleaning, paint finishing and air handling systems, plant layouts for such systems, ovens.

Wallace Herdlein, president of the new firm, contributes over 25 years of design engineering, manufacturing and administrative know-how to the group.

Prior to his 25-year Mahon association, he held positions with Ice Cooling Appliance Corp. as factory manager, and American Car & Foundry as development engineer.

Other officers of the new firm are *L. H. McCain*, vice-president; *R. K. Baker*, vice-president and treasurer; and *Oscar Stiska*, secretary.

NEWS FROM CALIFORNIA

The University of California at Los Angeles, Engineering Division, in cooperation with the Los Angeles Society for Coatings Technology, conducted a two-day conference on new product developments in the field of high polymer coatings September 14 and 15 on the UCLA campus.

Purpose was to present a broad program involving the present and future uses of high polymers in such industries as coatings, chemical, aircraft, electronics, steel, plastics, and others. The program was designed for research and development engineers and chemists, industrial engineers, technical supervisors and plant managers.

The significance of product development and evaluation was the theme of the September 14 morning session, which was presided over by *H. C. McClellan*, president, Old Colony Paint Co., Los Angeles, and former Assistant Secretary of Commerce. *Dr. Edward Coleman*, professor of engineering, UCLA, addressed the opening session on new mathematical design of experimentation.

Dr. Charles Overberger, head of the chemistry department of the Polytechnic Institute, Brooklyn, N. Y., discussed general chemistry of high polymers at the September 15 session. In his talk, Dr. Overberger, a recognized authority in the chemistry of high polymers, established the ground work for the subject matter of the following day.

Heard on the second day were *Temple C. Patton*, of Baker Castor Oil Co., Bayonne, N. J., who presented a review of the chemistry of urethanes and chemical properties of isocyanate compounds; *J. F. Heaps* of the research division of Monsanto Chemical Co., discussed a recently investigated aspect of physical properties of films laid down from emulsion vehicles. "New Approaches in Water Thinnable Vehicles" were discussed on September 15 by Dr. *Melvin J. Hatch* of Dow Chem. Co., Midland, Mich.; and "Epoxies" by a representative of Shell Chemical Co.

Harry Czyzewski, president of Metallurgical Engineers, Inc., Portland, Ore., has been appointed a member of the Oregon Board of Engineering Examiners.

The Norton Co. of Worcester, Mass., manufacturer of abrasives, has named *Irvine F. Williamson* as manager of

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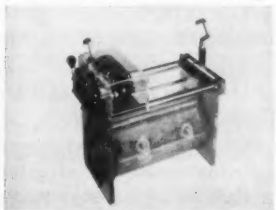
its plant in Santa Clara, Calif. He succeeded *George A. Garrison*, who has been appointed purchasing agent at the Worcester main office.

A flow-coating finishing line costing an estimated $250,000 is now in operation in the Transport Division plant of Boeing Aircraft Co. in Renton, Wash. The line is used for cleaning, deoxidizing, conversion coating, painting and drying a variety of parts for C-135 transports, commercial jets, and KC-135 tanker-transports.

The flow-coat line includes a tunnel equipped with a battery of nozzles which eject streams of epoxy on the parts passing through on a 1,000-foot-long conveyor at a speed of 10 feet per minute. An overhead monorail is fitted with 6,000 hooks on which the parts are hung.

The conveyor carries the parts through several steel-lined tunnels which accommodate parts with dimensions up to 4′ x 6′ x 1½′. Pre-coating stages of the operation include hot alkaline cleaning, water rinsing, deoxidizing, and a second water rinse. In the next step the parts move into the chemical conversion chamber, where a yellow-brown chemical paint base is applied. Subsequent steps include another rinse, dry-off oven, and cooling in an air bath. The final deposit is applied with nozzles in the coating chamber spewing epoxy onto the parts.

LAZO — The Pioneer in Lucite Barrel Platers for Better Metal Finishing



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Originators of Ribless Plating Barrels

HARDWOOD LINE MFG. CO.
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The re-cycle system is so designed that a 30 gallon reservoir performs work equal to a 3,000 gallon dip tank.

Previous methods of cleaning missile parts in a soak tank, then rinsing and hand scrubbing, have been replaced by an ultrasonic cleaner in the plant of Convair Astronautics in San Diego, Calif.

The unit, which reportedly cuts cleaning time on Atlas missile parts 50%, is described as the largest and most powerful ultrasonic cleaner of its type in commercial work. It has been installed near the Atlas intercontinental ballistic missile assembly line in the Convair plant and is employed for cleaning large fuel and oxygen system parts for the Atlas and Centaur missiles, for which the ultra in cleanliness is required.

The installation consists of two 500-gallon tanks, one for cleaning and one for rinsing. The tanks are alternately activated by a 25,000-watt generator. The cavitation action is reported to accomplish a faster and more thorough cleaning job on missile parts than any cleaning method previously used by this firm.

The system includes a recirculator, which pumps, filters, and heats the liquid in the tank, before the liquid reenters the tank on the return cycle.

The Shore-Calnevar Co., of Paramount, Calif., estimates that it has achieved economics of 55% in personnel and 65% in plating operations since switching from a manual finishing department to an automated finishing line for polishing and painting automobile hub caps.

An estimated 20% saving in floor space is also reported. The plant is equipped with one full automatic plating line for steel and one line for zinc die castings. The plating, polishing, and buffing units are completely conveyorized.

Steel parts are mounted on special plating racks for the cleaning, nickel base plating, and final chromium plating operations. The parts then move by conveyor through a drying oven to the paint department.

Zinc parts go directly from the die-caster to the polishing and buffing department, then by conveyor through a vapor degreasing machine. The die cast parts are plated with copper, nickel, and chromium, after which they are sent through the drying oven.

A. E. McIntyre, president, Malsbary Mfg. Co., Oakland, Calif., manufacturers of steam boilers for plating shops, recently was elected president of the Oakland Chamber of Commerce for the 1961-62 fiscal year.

The Huffored Division of the Siegler Corp. recently installed a new etch and conversion coating line in its El Segundo, Calif., plant for finishing spot-welded aluminum chasses.

The installation includes seven tanks of 1,500 gallons capacity each. Tanks used in prewelding operations include a chemical dip, running water rinse, etch, water rinse, and deoxidizing tank. Following spot welding, the parts are cleaned again, deoxidized, and given a conversion coating.

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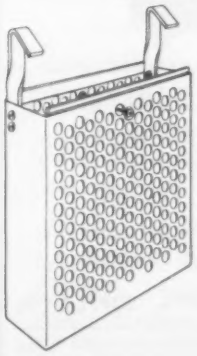

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IN STOCK

Acrid fumes of muriatic acid escaping from a broken valve on a 45,000 gallon tank on August 28 caused the evacuation of 125 persons from nine manufacturing plants in South El Monte, Calif.

The accident occurred when an employee of the J. F. Kerns Chem. Co. was drawing acid from the tank and the valve collapsed. In a matter of minutes the choking fumes were wafted throughout the South El Monte industrial section and caused workers in adjoining plants to flee.

Approximately 1,000 gallons of the acid spilled out over the rear lot of the Kerns Co. before firemen wearing gas masks stopped the leak. One employee was injured when some of the acid splashed into his right eye as he attempted to repair the leak.

Installation was recently completed at the Western Metal Decorating Co.'s plant in Cucamonga, Calif., on what is reported to be the first continuous horizontal steel and aluminum treating and painting line in Southern California.

The line, which is designed to handle both sheet and coil steel, is 270 feet long, operates at about 80 feet per minute, and cleans, treats and paints seven tons of steel per hour. At present, the company applies such finishes to metal as wood grain, an Irish linen pattern, leather-like finishes embossed to give a textural effect, vinyls, acrylics, polyesters, and alkyds. The predecorated coil steel is used in fabricating radio and television cabinets, cosmetic cases, rolled forms, tubing of various types, air conditioner housings, and other products.

February 15, 16 and 17 have been announced as dates for the 1962 Golden Gate Metals Conference, with the Fairmont Hotel in San Francisco as the site. Conference chairman *Wallace J. Erichsen* has announced that plans are underway to accommodate 800 engineers and scientists from the eleven Western states. The general conference theme will be "Materials Science and Technology for Advanced Applications." Sessions are scheduled on space age materials, applications and processing, electronic materials applications, new materials and process, and nuclear power in the space age.

A new wet-enameling department was recently established in the Richmond, Calif., plant of the American Radiator & Standard Corp. for the porcelain enameling of pressed steel bathtubs on a mechanical production scale.

The Richmond plant (situated in the San Francisco Bay area) produces 600 bathtubs a day, plus a line of numerous, smaller enameled plumbing items, such as sinks, bowls, medicine cabinets, laundry trays, etc.

Enameling operations in the plant are now handled in two departments. Dry-enameling of cast iron tubs, which are received from the foundry, is done with facilities which have been in operation for some years. A recent expansion program involved the installation of a completely conveyorized steel bathtub department for wet-enameling. The new department is housed in a separate building, in which equipment for mixing and milling the various frits for the pressed steel tubs has also been installed.

The equipment in the new department includes a 10-stage cleaning machine. The tubs move through the pickling operation on a mesh belt, which passes through the center of a 10-tank cleaning line. The tanks, in order of use, are an alkali clean, hot rinse, alkali clean, hot rinse, sulfuric acid pickle, cold rinse, nickel sulfate flash, cold rinse, acid neutralizer, and neutralizer tank.

After a spray-applied ground coat, the tubs are conveyed through a bake oven to set the undercoat at 1610°F. The cover coat of enamel is applied manually in a six-station spray booth set-up. After passing through a drying tunnel, the tubs move by conveyor into the furnace, where the enamel cover coat is fired at 1530°F. for 30 minutes.

Because perfect weight displacement and balance is an important factor in the manufacture of golf club heads, the Wooley Mfg. Co., of Escondido, Calif., has developed three separate grinding or polishing operations on milled iron forgings to give the necessary precision measurements to the clubs.

The firm has found that abrasive belt grinding provides the dual factors of versatility and economy in metal removing and finishing operations. After the pre-plating operations of grinding to size and shape have been completed, the club face is manually blasted in a blast cabinet. This is followed by sisal buffing, hard chromium plating and color buffing.

Eight tanks are used in the plating sequence, which includes alkali cleaning, rinsing, plating, and final rinsing.

The 1961 edition of Western Electronic Manufacturers Association's Directory, issued in August, brings to

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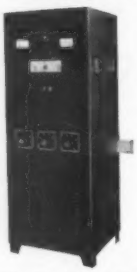
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light the impressive growth which the electronics industry and its allied activities, such as metal finishing, have experienced in the past few years.

The statistics published in the directory reveal that electronics has emerged as the West's and California's No. 1 source of factory sales and jobs.

The directory revealed that, in 1960, the West accounted for 24.2% of the nation's $10.2 billion total factory sales in electronic equipment. A projection for 1961 indicated that the West will have $2,815 million sales, up 14.2% from 1960's $2,465 million.

The WEMA directory sets forth that, in the last five years, the West's factory sales have climbed 58.6%, up $1,040 million from 1957's $1,775 million; and that the West now accounts for nearly 24.6% of all employment in the U. S. electronics industry, with 215,000 of the nation's 875,000 electronics-based jobs.

Los Angeles, San Francisco, and San Diego account for 184,300 of the 215,000 employees, or 85.7% of the western total and 21% of the nation's. Regional employment figures are 59.5% for Los Angeles, 21.15% for San Francisco and 5.2% for San Diego.

The California plating industry plays a part of ever growing importance in the booming electronics industry. While the WEMA undertook to include in its 1961 directory no breakdown of the number of plating shops and their employees engaged in electronics and missile work, it is estimated that in excess of 250 finishing shops in California are now active in this type of work, as compared to a negligible number five years ago.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Midwest Regional Council

Argonne National Laboratories, Lemont, Ill., will be the host for the Third Annual Technical and Workshop Session of the Midwest Regional Council on Saturday, October 28, 1961. A symposium, "Plating On Uncommon Basis Metals" will be the highlight of the meeting to be held in conjunction with the traditional workshops on metal finishing problems. A steak dinner and a guided tour of the atomic reactors at this government site will be included in the $9.00 registration fee. Registration blanks and programs will be mailed in the near future to all members of the A.E.S. whose branches comprise the Midwest Regional Council.

CHEMICAL INSTITUTE OF CANADA

R. A. Hartley of Montreal has been named the first prize winner of the 1961 Protective Coatings Award which is offered by the Protective Coatings Division of the Institute. Second prize was awarded to *R. N. O'Brien* and *R. N. Swindlehurst* of the University of Alberta, Edmonton.

The awards are given for the best technical paper directly related to protective coatings and are $100 and $25 respectively. Actual presentation will be made in February at the Division's two-city meeting — Feb. 22 at the Seaway Hotel, Toronto, and Feb. 23 at the Windsor Hotel, Montreal.

Mr. Hartley, who is technical manager, International Paints (Canada) Ltd., Montreal, received the award for his paper "Surface Coatings for Marine Conditions." The O'Brien - Swindlehurst paper was entitled "Effect of Mild Catalysis on Two-Component Polyurethane Films." This will be the second presentation of these awards which were established in 1959.

OBITUARIES

WILLIAM LAWRIE, SR.

William Lawrie, Sr., founder of Redi-Products Co., Milwaukee, passed away recently. His firm is well known for "Rediglu," a polishing wheel cement, and other items for the finishing industry.

Mr. Lawrie was active in Great Lakes yachting circles and was a former commodore of the South Shore Yacht Club in Milwaukee. His son, William T. Lawrie, survives.

A. J. FISHER, JR.

A. J. Fisher, Jr., executive vice-president, *Metal & Thermit Corp.*, died Friday, August 11, 1961, at Norwalk Hospital, Norwalk, Conn. He was 47.

Mr. Fisher joined the firm in 1955

CALENDAR

Oct. 16-19: 2nd International Congress on Vacuum Technology, Sheraton Park Hotel, Washington, D. C.

Oct. 23-27: 43rd National Metal Show and Congress, American Society for Metals, Cobo Hall, Detroit, Mich.

Oct. 28: 3rd Annual Technical and Workshop Sessions, Midwest Regional Council, Argonne National Laboratories, Lemont, Ill.

Oct. 30-Nov. 1: 74th Annual Meeting, Nat'l. Paint, Varnish and Lacquer Assoc., Statler-Hilton Hotel, Washington, D. C.

Nov. 2-4: 39th Annual Meeting, Federation of Societies for Paint Technology, Shoreham Hotel, Washington, D. C.

Dec. 1-2: Annual Educational Meeting and Banquet, Detroit Branch A.E.S., Statler-Hilton Hotel, Detroit, Mich.

Dec. 15-16: Annual Educational Session and Banquet, Newark Branch AES, Robert Treat Hotel, Newark, N. J.

Jan. 20: Annual Meeting, Grand Rapids Branch AES, Pantlind Hotel, Grand Rapids, Mich.

Jan. 27: Annual Educational Meeting and Banquet, Chicago Branch AES, Conrad Hilton Hotel, Chicago, Ill.

Jan. 30-Feb. 2: 18th Annual Technical Conference, Society of Plastics Engineers, Penn-Sheraton Hotel, Pittsburgh, Pa.

Mar. 6-7: 5th Annual Technical Conference, Society of Vacuum Coaters, Sheraton-Cleveland Hotel, Cleveland, Ohio.

81.73% RENEWALS

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as a member of the market research department, and was elected executive vice president in 1960. Prior to this association, he was manager of chemical sales development for U. S. Industrial Chemicals, Inc., New York, and president of U. S. Polymeric Chemicals, Inc., Stamford, Conn.

He was former secretary and a director of the Chemical Market Research Assn., and a director of the Commercial Chemical Development Assn.

Mr. Fisher was a native of Rochester, N. Y. He was graduated from Phillips Exeter Academy in 1932, and from Princeton University in 1936. A resident of New Canaan, Conn., Mr. Fisher was a member of the board of governors of the Country Club of New Canaan and president of the Princeton Alumni Association there.

He is survived by his wife, *Mrs. Elizabeth Roberts Fisher;* a son, Thomas Roberts; a daughter, Elizabeth; and his father, *Arthur James Fisher* of Clearwater Beach, Fla.

WILLIAM K. SPROULE

William Kelvin Sproule, consulting metallurgist with the Development and Research Division of *The International Nickel Co., Inc.,* died in New York on August 8, after a long illness. He was 48 years old.

Mr. Sproule had been associated with the company since June, 1937, when he joined the research department of The International Nickel Company of Canada, Limited, at Copper Cliff, Ontario. He became superintendent of research at Copper Cliff in 1948, and served in that capacity until his appointment as consulting metallurgist, in 1956.

A native of Montreal, Quebec, Mr. Sproule was a graduate of McGill University, receiving the degree of B. Eng. (Metallurgy) in 1936, and the degree of M.Sc. in 1937. He was a member of the Canadian Institute of Mining and Metallurgy, the Engineering Institute of Canada, the American Society for Metals, the American Institute of Mining, Metallurgical, and Petroleum Engineers and the Society of the Sigma Xi.

Mr. Sproule resided with his family at 27 Hawthorne Place, Summit, New Jersey. He leaves his wife, Phyllis Turner Sproule, and three children, David, Jane and Gordon, all of Summit.

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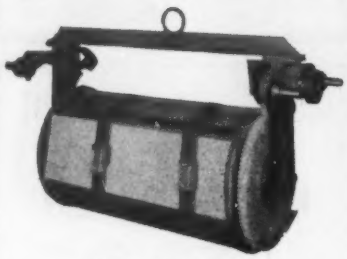

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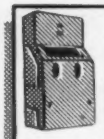

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1601 Douglas Ave., Kalamazoo 54, Mich.

Hammond Solvents Recovery Service
241 Brunswick St., Hammond, Ind.

Handy & Harman
850 Third Ave., New York 22, N. Y.

Hanson-Van Winkle-Munning Co. 8, 9, 49, 87
Matawan, N. J.

Hardwood Line Mfg. Co. 113
2022 N. California Ave., Chicago 47, Ill.

Harshaw Chemical Co., The 15
1945 E. 97th St., Cleveland 6, Ohio

Heatbath Corp.
Springfield 1, Mass.

Heil Process Equipment Corp.
12914 Elmwood Ave., Cleveland 11, Ohio

Holland & Sons, Inc., J.
475 Keap St., Brooklyn 11, N. Y.

Hooker Chemical Corp. 28
1310 Union St., Niagara Falls, N. Y.

Hubbard-Hall Chemical Co.
28 Benedict St., Waterbury 20, Conn.

Hull & Co., Inc., R. O.
1302 Parsons Ct., Rocky River 16, Ohio

Hydra & Power-Blast Mfg. Div., Automation Services, Inc. 118
P. O. Box 5554, Detroit 38, Mich.

Ideal Chemical Co. 118
1499 Dean Dr., So. Euclid 21, Ohio

Illinois Water Treatment Co.
840 Cedar St., Rockford, Ill.

Imperial Industries, Inc. 48
4436 Walker Ave., Wayne, Mich.

Industrial Filter & Pump Mfg. Co. 14
5906 Ogden Ave., Cicero 50, Ill.

International Nickel Co., Inc., The 33
67 Wall St., New York 5, N. Y.

Jelco Finishing Equipment Co.
153 E. 26th St., New York 10, N. Y.

Joyce Research and Development Corp.
249 W. Merrick Rd., Valley Stream, N. Y.

Kelite Corp.
81 Industrial Rd., Berkeley Heights, N. J.

Koch Sons, Inc., George 109
10 S. 11th Ave., Evansville 4, Ind.

Kocour Co. 45
4800 So. St. Louis Ave., Chicago 32, Ill.

Kosmos Electro-Finishing Research, Inc.
140 Liberty St., Hackensack, N. J.

Kushner, Dr. Joseph B. 113
621 S. Norman, Evansville 14, Ind.

Lasalco, Inc. 7
2820-38 LaSalle St., St. Louis 4, Mo.

Lea Mfg. Co. 39
16 Cherry Ave., Waterbury 20, Conn.

Lea-Michigan, Inc. 109
14459 Wildemere Ave., Detroit 38, Mich.

Lea Products Co. 44
996 De Boullion St., Montreal 15, Quebec, Can.

Lea-Ronal, Inc. 40
130-19 180th St., Jamaica 34, N. Y.

L'Hommedieu & Sons Co., Chas. F.
4521 Ogden Ave., Chicago 23, Ill.

Lindale Equipment & Supply Corp. 117
504 Smith St., Brooklyn 31, N. Y.

Macarr, Inc.
4360 Bullard Ave., Bronx 66, N. Y.

MacDermid Inc. Back Cover
Waterbury 20, Conn.

Magnus Chemical Co., Inc.
11 South Ave., Garwood, N. J.

Manhattan Rubber Div., Raybestos-Manhattan, Inc. 48
6 Willett St., Passaic, N. J.

Matchless Metal Polish Co.
840 W. 49th Pl., Chicago, Ill.

Meaker Co., The
Sub. of Sel-Rex Corp., Nutley 10, N. J.

Mearl Corp., The
41 E. 42nd St., New York 17, N. Y.

Metal & Thermit Corp. 52, 96, 97
Rahway, N. J.

Michigan Buff Co., Inc. 118
3503 Gaylord Ave., Detroit 12, Mich.

Mitchell-Bradford Chemical Co. 42
Wampus Lane, Milford, Conn.

Motor Repair & Mfg. Co., The 118
1555 Hamilton Ave., Cleveland 14, Ohio

Murray Way Corp. 30
P. O. Box 180, Maple Rd. E., Birmingham, Mich.

Nankervis Co., Geo. L. 38
16000 Fullerton, Detroit 27, Mich.

National Plastics & Plating Supply Co.
Box 34, Terryville, Conn.

New Holland Machine Co. 108
New Holland, Pa.

N. J. Thermex Co., Inc. 92
535 Bergen St., Harrison, N. J.

Northwest Chemical Co. 36
9310 Roselawn Ave., Detroit 4, Mich.

Nuodex Products Co.
Box 242, Elizabeth, N. J.

Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.

Packer Machine Co.
456 Center St., Meriden, Conn.

Park Equipment & Supply Corp. 118
604 - 20th St., Brooklyn 18, N. Y.

Pesco Plating Equipment Corp. 118
75 Wythe Ave., Brooklyn 11, N. Y.

Pfizer & Co., Inc., Chas. 32
630 Flushing Ave., Brooklyn 6, N. Y.

Phelps Dodge Refining Corp.
300 Park Ave., New York 22, N. Y.

Phillips Manufacturing Co. 101
3475 Touhy Ave., Chicago 45, Ill.

Pittsburgh Plate Glass Co., Chemical Div.
One Gateway Center, Pittsburgh 22, Pa.

Plating Products, Inc.
1509 N. Washington, Kokomo, Ind.

Puma Corp. 91
P. O. Box 82, Farmingdale, L. I., N. Y.

Randolph Products Co. 111
92 N. 12th St., Carlstadt, N. J.

Ransburg Electro-Coating Corp.
3939 W. 56th St., Indianapolis 23, Ind.

Rapid Electric Co., Inc. Inside Front Cover
2881 Middletown Rd., Bronx 61, N. Y.

Raybestos-Manhattan, Inc. Manhattan Rubber Div. 48
Passaic, N. J.

Reliable Industrial Equipment Co., Inc. 117
633 Richmond St. N.W., Grand Rapids 4, Mich.

Rona Pearl Corp., Div. Rona Laboratories, Inc.
E. 21st & E. 22nd Sts., Bayonne 3, N. J.

Schaffner Mfg. Co., Inc. 46
Schaffner Center, Emsworth, Pittsburgh 2, Pa.

Seaway Nickel Div., Roblin-Seaway Industries, Inc. 50
No. Tonawanda, N. Y.

Sel-Rex Corp. Inside Back Cover
75 River Rd., Nutley 10, N. J.

Service Research & Development Co., Inc.
Rt. 22 and Greeley Ave., Union, N. J.

Sethco Mfg. Corp. 84, 85
2286 Babylon Turnpike, Merrick, L. I., N. Y.

Singleton Co., The 43
11720 Berea Rd., Cleveland 11, Ohio

Sommers Bros. Mfg. Co. 114
3439 No. Broadway, St. Louis 7, Mo.

Stevens, Inc., Frederic B. 16
1808 - 18th St., Detroit 16, Mich.

Stutz Co., The 29
4430 W. Carroll Ave., Chicago 24, Ill.

Technic, Inc. 51
88 Spectacle St., Cranston, R. I.

Titanium Products Corp. 113
9301 French Rd., Detroit 13, Mich.

True Brite Chemical Products Co. 106
P. O. Box 31, Oakville, Conn.

Turco Products, Inc.
24600 So. Main, Wilmington, Calif.

Twin City Testing Corp.
P. O. Box 95, Tonawanda, N. Y.

Udylite Corp., The 19-22
Detroit 11, Mich.

Unit Process Assemblies, Inc. 38
53-15 37th Ave., Woodside 77, N. Y.

Unitron Instrument Co., Microscope Sales Div.
66 Needham St., Newton Highlands 61, Mass.

Univertical Corp. 100
14841 Meyers Rd., Detroit 27, Mich.

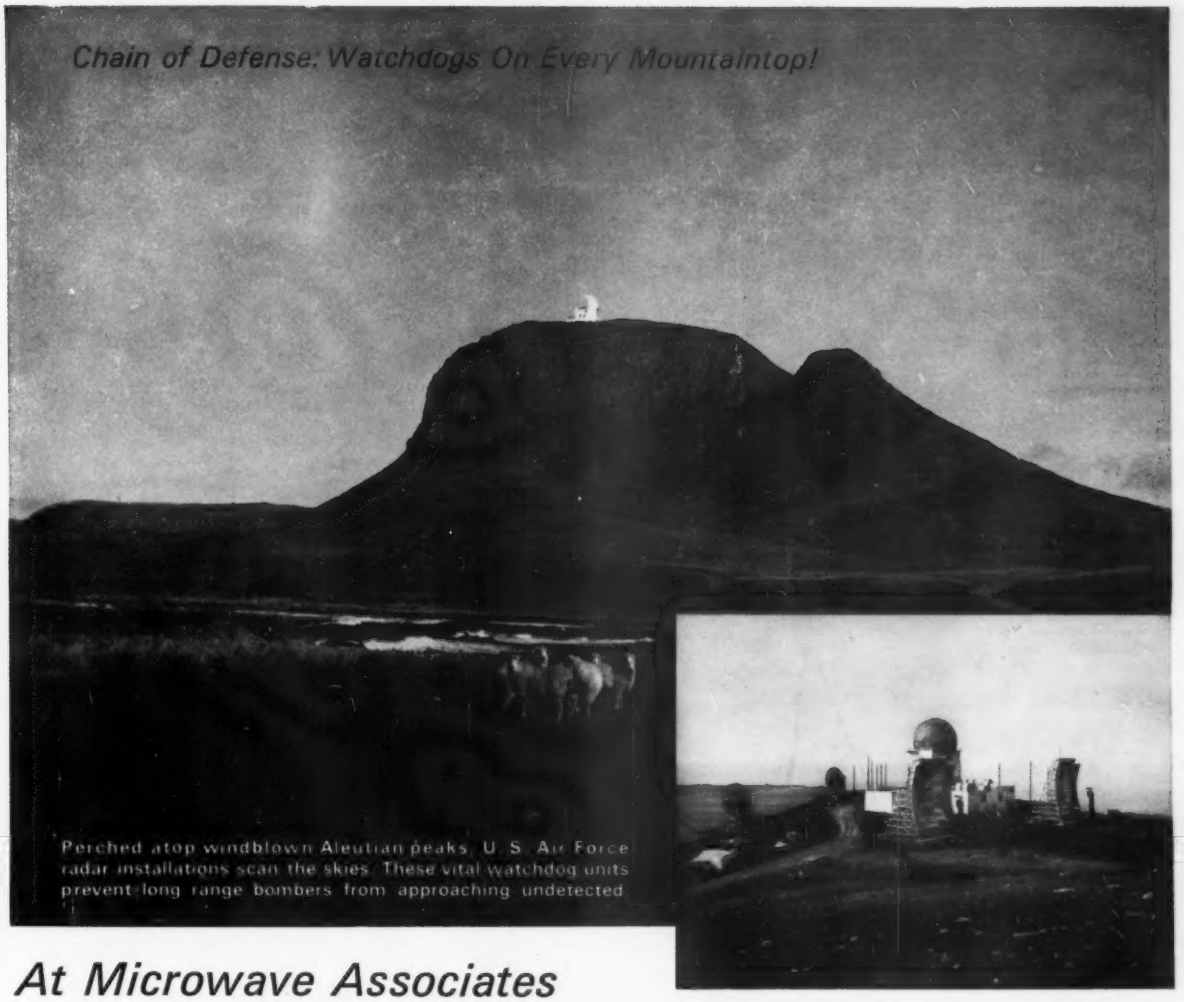
Vic Manufacturing Co. 41
1313 Hawthorne Ave., Minneapolis, Minn.

Virginia-Carolina Chemical Corp.
401 E. Main St., Richmond 8, Va.

Worthy Products Co. 117
Box 1432, Boca Raton, Fla.

Wyandotte Chemicals Corp. 23
Wyandotte, Mich.

Zialite Corp.
92 Grove St., Worcester 5, Mass.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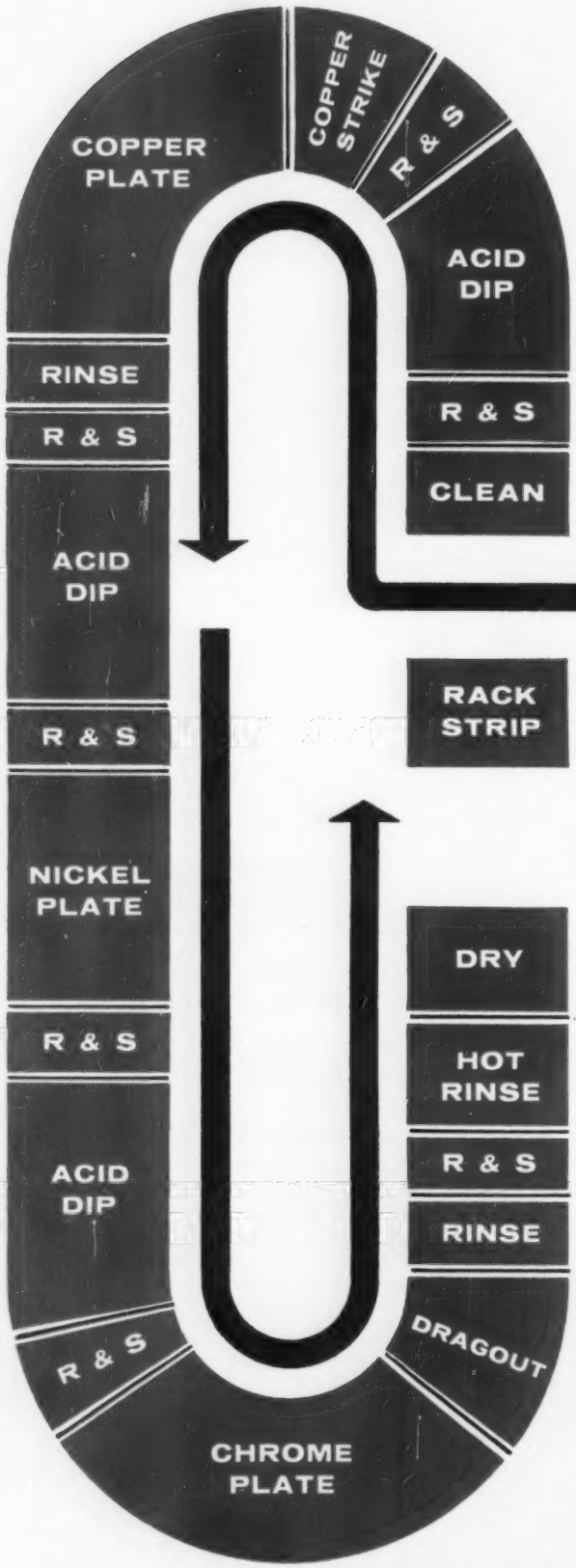

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